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THE CULTIVATION OF THE PEANUT.

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DESCRIPTION.

The Peanut, "*Arachis Hypogeia,*" also known frequently as the earth or ground nut, is a plant of annual habit, belonging to the natural order Leguminoseæ or pod-bearers, and in common with most other members of the pea family has the power of obtaining its nitrogen supply from the atmosphere and storing it up in nodules on the roots.

Unlike other legumes, excepting the Bombarra ground nut, "*Voandzeia Subterranea,*" this plant, while blooming above ground, matures its pod or fruit under the surface of the soil. The yellow flowers are borne at the joints where the leaves are attached to the stem, in the bunch or upright varieties at the base of the plant, and in creeper or procumbent varieties right along the stems. Upon pollination taking place the flower fades, and falling off leaves the stalk with a thickened pointed end called the "peg" or "point," which grows down into the soil, where it matures into the pod or so-called nut. It is apparent from this that the soil on which the crop is grown should be of a soft or friable nature or such that a loose surface can be easily maintained.

RANGE.

The peanut can be grown over the whole of Queensland, and while in the cooler parts it only succeeds in summer, in the tropical portions it may be grown at any period of the year where a sufficiency of rain falls.

The period of growth ranges according to variety and climate from fifteen to twenty weeks, the longest period being taken up by the creeper or procumbent varieties.

A moderate rainfall, plenty of sunshine, and a comparatively high temperature best suit the crop, and departures from these may result in a more lengthened period of growth. The crop can also be grown under irrigation.

SOILS.

The nature of the soil on which the crop is grown, besides its fertility, is the main factor in a profitable crop. A loose texture is desirable to allow the pegs to easily penetrate and expand to form the pods and mature evenly, as well as to permit of easy harvesting in freeing the nuts from the soil. Good drainage is also essential, more especially when a heavy rainfall is liable to occur during the growing period.

Light sandy loams are best adapted for the production of peanuts for market as edible nuts, since the shells are clean and bright. Soils inclined to be clayey are apt to stain the shells, and though the berries or peas may be of equal quality, the clean, bright shell, being more inviting, will naturally command a better price. Ill-drained or sour soils are not desirable. Peanuts may be grown on most soils except a heavy or puggy clay, but except in the loose, friable soils they should only be grown for feeding off.

ROTATION.

Peanuts should always be grown in a rotation, as though owing to the roots being harvested the same quantity of nitrogen is not left in the soil as with other legumes, where the whole root system is available, a sufficient quantity of the nodule-bearing rootlets are left to exert an influence on the following crop. At Tolga, in a comparison with potatoes grown on land on which the previous crops were maize and peanuts, the yield on the portion previously cropped with peanuts was estimated by an official of the Department to be 9 tons of tubers as against 6 tons on that previously cropped with maize. In the rotation, however, the peanut, when harvested, should not take the place of the legume or other crop that is ploughed under to restore the organic matter in the soil, and should only be looked upon as adding a quantity of nitrogen. Where the whole growing plant is ploughed under it answers the same purpose as cowpeas, Mauritius, and velvet beans, &c.

In orchards, either as a crop to be ploughed under or to be harvested, the peanut is commended.

FERTILISERS AND LIME.

In common with other legumes, the peanut thrives best in a soil in which there is a sufficiency of lime. Not all soils require the addition of lime, but most soils in districts subject to heavy rainfall, and which give an acid reaction, will benefit by an application of from 5 to 10 cwt. of stone lime or 10 to 20 cwt. of earthy lime or pulverised limestone to the acre, broadcasted (not ploughed in), preferably a week or more before applying commercial fertiliser and sowing the seed. The cultivation of the crop will sufficiently work this lime into the soil. Where any doubt exists as to the necessity of applying lime to the soil, a portion should be limed and the resultant crop compared with a similar area unlimed.

In applying manures for the crop, care should be taken to only apply organic manure in a well rotted condition, and then only in small quantities and thoroughly mixed with the soil. Larger quantities or fresh manure will result in many of the pods being poorly filled. These poorly-filled pods are known as "pops" or "duds."

Organic manures should be applied to a previous crop to get the best results.

As the peanut is a legume and draws nitrogen from the air, this element is not called for in quantity in the fertiliser, but its presence in small quantity, say, 2 per cent. or 3 per cent., will be beneficial. Phosphoric acid and potash will be the chief elements in the fertiliser, and the quantities will be dependent on the soil content. In general, a fertiliser containing from 10 to 12 per cent. phosphoric acid, 2 to 3 per cent. nitrogen, and 6 to 8 per cent. potash will be a good mixture, and may be applied in quantities of from 1 cwt. to 5 cwt. per acre. Such a mixture can be obtained with 1 part sulphate ammonia, 7 parts superphosphate, and 1½ parts sulphate of potash.

The most suitable application will be discovered by applying varying quantities over a small area and noting results, but usually 2 cwt. is sufficient.

Commercial fertilisers are usually applied immediately prior to planting a crop, and as the roots of the peanut do not spread to any distance, the application in the drill with a fertiliser distributor having one or two tines at the back will greatly aid in mixing the fertiliser with the soil.

Ashes from the forest hardwoods, which contain lime and potash, are useful, and may be applied to the soil broadcast in a similar manner to lime at the rate of about 10 cwt. to the acre. These ashes, however, should not previously have been exposed to rain, as then a great deal of their value will have been lost. The ashes of soft woods growing in the scrubs are not considered so good.

SELECTION OF SEED.

As with other crops, in order to secure the best results it is essential that the seed of the peanut should be of the highest grade. Poor seed cannot be expected to yield a good return. In the first planting, seed should be secured from a heavy producing crop and subsequently carefully selected in the field from the heaviest producing plants of the required type. A good plan is to select the nuts from the best producing plants and sow these in a special seed patch, each year selecting the best of this area for next year's seed patch. Nuts harvested for seed should be fully matured, handled carefully, and not picked from the plants for several weeks after curing; they should then be picked by hand and the selected ones thoroughly dried and stored in a dry place free from mice or insect attack. Storage in tanks in a similar manner to maize is most satisfactory.

METHODS OF PLANTING.

The seed can either be planted whole or shelled. Whole nuts may be soaked in cold water twelve to twenty-four hours, drained, dried for an hour or two to assist handling, and then planted. This accelerates germination. Shelled seed should not be soaked.

Where shelled seed is used the shelling should be done by hand, though hand shellers carefully handled are sometimes used. All shelled seed in which the thin skin covering the seed is broken should not be sown, as this injury is liable to affect germination.

Breaking the pods in two answers the same purpose as shelling. Where the seed after planting may be subject to attack by vermin, the seed may be treated by sprinkling with a solution of equal parts of stockholm tar and kerosene. In this case, however, to protect the maturing crop it is advisable to destroy, by poisoning, the vermin beforehand.

Whether planted whole or shelled the operation may be effected by hand or with planters especially designed for the purpose.

AMOUNT OF SEED.

The amount of seed required to plant an acre is about 40 lb. of the whole nuts and from 25 to 30 lb. of whole nuts shelled, varying slightly according to the weight of the nut and the distance apart they are planted. Some growers use as much as 60 lb. per acre of the large podded varieties. It is interesting to note that the whole nut, when planted, provides but one plant, but if shelled and the kernels planted apart, two plants will result.

TIME OF SOWING.

According to the climates of the various districts, so will the time for planting vary.

In the cooler districts, sowings may be made when all danger of frosts is over and the soil can be expected to be reasonably warm, September, October, November, and December being suitable months. In the tropics the crop can be grown practically throughout the year, but consideration must be given to climate and rainfall—*i.e.*, sufficient rainfall should be obtained to grow the crop and fine weather be expected at harvest time.

In the tropical portions of the State, where the monsoonal rain or wet season commences in December, the main crop is sown in January, February, and March, according to the likelihood of reasonably fine weather in the months of April, May, and June or July, when harvesting should occur.

In planting large areas it is recommended to spread the sowings over such a time as will allow of harvesting one lot before the next is over-ripe. Peanuts left too long in the ground are easily detached from the plant and consequently more difficult to harvest, while some varieties are liable to sprout.

LENGTH OF CROP.

The large nuts or creeper varieties require a longer time for growth to maturity than do the bunch or upright varieties, the time varying from fifteen to seventeen weeks for the bunch varieties and from seventeen to twenty weeks frequently for the creeper variety.

PREPARATION OF LAND.

In preparing the land for peanuts the first ploughing may be deep, but the second should not be deeper than 6 in., preferably 5 in. This top 5 in. should be brought to a fine tilth and be free from weeds and trash.

Where lime or ashes have been applied the land is harrowed and drills drawn out, in which the fertiliser, if any, is mixed and the peanuts sown either by hand or with the planter. The drawing of drills may be done with the fertiliser distributor, or the whole operation can be done with a seed drill and fertiliser distributor combined.

Where no seed drill or fertiliser distributor is obtainable, the drills could b drawn out with a cultivator having a wide shovel attachment in the rear, the fertiliser dusted along this by hand, the cultivator then run along the drill with tines set close in front to mix the fertiliser with the soil, and the shovel attachment set at the back to reopen the drill for the reception of the seed to be dropped by hand; this drill should not be deeper than 4 in. from the levelled surface of the soil, and the seed should be covered to a depth of 2 to 3 in., according to the texture of the soil and its moisture content. In light soils where evaporation is great the deeper planting is preferable, but in stiffer soils the shallower covering should be adopted.

A light firming of the soil over the seed is desirable, and this is obtained in the seed drill by a wheel at the rear. When planted by hand the area may be covered with the harrow, or preferably by the cultivator, with tines straddling the drill and set so as to throw the soil inwards.

TIME OF GERMINATION.

Germination usually occurs with shelled nuts in five days, but is subject to the amount of moisture and heat in the soil. The whole nuts take longer unless first soaked in water, as the moisture has to penetrate the shell to affect the berry or pea which contains the germ.

SPACING.

The intervals between drills and the spacings between seeds in the drills vary somewhat, according to the richness of the soil and the variety planted.

The bunch or upright varieties take up much less room than the creeper or procumbent kinds, and the growth of both is correspondingly greater on the richer soil.

In general, the drills are drawn out from 30 in. to 42 in. apart, the distance being influenced by the space required by the cultivating implement.

The spacing of the seed in the bunch varieties may be from 6 to 12 in. apart, and of the creeper varieties from 12 to 24 in. apart in the drill. An instance of success with close planting is noted from an experiment in which, in a light sandy loam, the bunch varieties were planted 3 in. apart in drills 30 in. wide. It is thought, however, in richer soils this crowding of the plants would be detrimental.

CULTIVATION.

Where close planting has been adopted the land may be harrowed with a light harrow shortly after the plants appear through the surface. Otherwise it will be better to use the cultivator between the rows and the hand hoe, where necessary, between the plants. The first one or two cultivations should be done with fine points, as in the strawberry cultivator or the 1¼-in. or narrowest shovel points supplied with the usual 5-tooth cultivator; after this the broader points can be used and later the hilling attachments. In early cultivations the cultivator can work close to the roots, but not deeper than 2 in.; but later, after flowering, when the pegs enter the soil care should be taken that the plant is not disturbed.

In most soils it is desirable to draw a little of the soil in towards the plant to provide a bed of fine earth in which later the pods may form, and this can be done at each cultivation, finally leaving a flat bed in which the plants are growing with a water furrow between each drill. The height to which hilling may be practised depends largely on the soil. Usually, the heavier the soil the more necessity for hilling.

Soil should not be thrown on the centre of the plant, the object of hilling being to provide fine soil for the pegs to enter and mature evenly and for ease in harvesting. As a rule, in the creeping varieties the pegs easily reach the soil, but in certain cases a light roller run over the crop will facilitate this operation. In the bunch or erect growing varieties no rolling should be attempted, but a final higher hilling made if it is noticed the points have some distance to go to reach the soil.

HARVESTING.

The time for harvesting is noted in the appearance of the foliage, which starts to yellow or lose colour, and by examination of the nuts. If the majority of the berries or peas are full grown and the inside of the shell has begun to colour and show darkened veins, the crop is mature and harvesting should not be delayed.

If the crop is harvested too early the proportion of "duds" is very great, while if deferred too long some of the nuts may germinate and others become detached from the plant when lifting, while the tops, having lost most of the leaves, will be of much less value for fodder. In some soils, notably the friable chocolate volcanic loams, the plants may be lifted by hand, when most of the nodule-bearing rootlets are left behind and only the root stock with the nuts are lifted. In other cases it is necessary to loosen the soil before lifting out. In small areas this is sometimes done with the digging fork inserted under the plant, which is lifted while the fork is worked underneath. In large areas a potato digger with an endless belt elevator from the shovel point is found very effective where the soil is dry enough to fall through the slats of the elevator and the crop is free from weeds.

A very satisfactory digger could, however, be made on the farm or by a local blacksmith by attaching to an ordinary wooden plough beam a knife edge to go under the plant and cut the roots just below the nuts; finger bars at the rear of this knife edge would lift the plants and loosen the earth, thus facilitating the lifting by hand. The width of the knife edge should be sufficient between the attaching portions to

the beam to allow of the whole plant passing through, and the depth should be regulated by the wheel or wheels in front. Perhaps a better idea might be given by taking the back off an ordinary earth scoop, together with all the bottom excepting 6 in. in front, and substituting finger bars slightly elevated to carry the plants and attaching the whole to a plough beam with handles. In a digger of this description, where one horse was used, the digging attachment would be to one side of the beam, while with two horses it would be in the centre, the operator straddling the row and the depth regulating wheels being preferably two, one on each side of the line of plants.

Where an ordinary plough is used the share should cut 10 or 12 in. wide and the mould board removed and some rods substituted to prevent the tops being mixed with the soil.

It should always be remembered that the cutting of the roots as close to the pods as possible results in the greater quantity of nitrogen being returned to the soil.

Harvesting should not begin until the dew is off and the tops are dry, and the operation should be regarded as a hay-making of the tops, and not more than can be handled should be lifted in any one day.

CURING.

After the plants are lifted and the soil shaken from the nuts they are allowed to lie either spread on the ground or in small bunches until the leaves are wilted, but not curled or brittle. They are then bound in small sheaves or taken separately and stacked until cured. The time in which the plants are allowed to wilt varies according to the weather, and in some cases stacking may be necessary within an hour of lifting.

The usual method of curing peanuts where the quantity is large is to place them in small stacks around a pole. From twenty to thirty poles will be required for an acre.

These poles should be reasonably stout, from 2 to 3 in. of hardwood in diameter at the bottom end, which should be sharpened. When erecting, holes are made in the soil with a crowbar, post-hole digger, or earth auger, and the pole inserted or driven down with a mall to a depth that will ensure their not being blown over with the weight of the stack upon them. Crosspieces about 3 ft. in length are now nailed across the post at right angles, one immediately above the other, 9 to 10 in. above the level of the ground; 3 by 1-in. hardwood battens answer the purpose admirably. According to the crop, six or seven rows are taken on each side of the poles, and the plants, when wilted, forked into one row on either side of the pole. When stacking, a few vines are placed across the crosspieces, which keep them off the ground, to form the foundation. The vines are then stacked by hand with the nuts next to the pole and tops outward, pressing down each layer and building evenly around the pole. From time to time a bunch should be divided and hung around the pole to bind the mass and to assist in keeping the centre high.

This latter is important in that it allows any rain falling to run off. When the stack is approaching 3 ft. high the vines should be drawn closer round the top and finished off with a cap of grass as a thatch to run rain off. It is important that free circulation of air should obtain through the stack in order to facilitate curing. The building of thick or high stacks or pressing them too tight will tend to cause heating, with consequent damage to both fodder and nuts.

After about two weeks in the stack the peanuts may be stored in the barn, but the nuts should not be picked from the vines until preferably six weeks from the date of harvesting, as if picked too soon they are liable to shrivel, and there is danger of fermenting or moulding after picking.

PICKING.

The usual practice in this State has been to pick the nuts from the cured plants by hand—a tedious process, the cost of which, if the ruling rate of wages were paid, would be prohibitive, since 60 lb. is considered a fair day's work. This practice of hand picking has been followed for ages, and is still the usual method adopted in countries such as India, China, Japan, &c., where labour is plentiful and cheap. In certain cases, too, the nuts are washed by agitation in frequently changed water and dried in the sun to obtain a clean inviting article for edible purposes. This is necessarily a costly undertaking, and would need a much higher price for washed nuts to compensate.

Other methods adopted in North Queensland with a lessening of expense have been, in the case of the bunch nuts, to hold the stems in the hand and thresh the nuts off by beating across tightly-drawn wires or the edge of a board placed midway across

a box or other receptacle to hold the nuts, and with both bunch and creeper to rub the whole plant over a wire netting drawn tight until the nuts fall through. Subsequent winnowings remove trash and light pods, and it is stated thoroughly drying the resultant nuts in the sun will cause the stems or tails to break off in the bags, resulting in a clean sample when it reaches the market.

In other lands, however, labour and time saving machinery has been evolved which does very satisfactory work in picking, stemming, cleaning, grading, and bagging for market, without breaking or damaging any appreciable quantity of the pods.

Two types of pickers are on the market in the United States of America—one working on the principle of a cylinder grain-thresher and the other one in which the plants are drawn between spring points over a wire mesh in such a manner that the nuts are pulled off and fall through on to a conveyor, which carries them through a winnowing process to a stemming apparatus, after which they go through a further winnowing and a cleaning and grading process. Two machines of the latter type are in use in the Cooktown and Tableland districts respectively.

The cost of machines of this description is too great for the individual in most cases, and it would be advantageous, where any considerable area was under crop, for farmers to co-operate in the purchase, when the machine, which is on wheels, could be transported from farm to farm.

Contract picking is a feature in the United States just as contract chaffcutting is in Australia. The picking crew, working day after day, naturally become expert; so that a greater average quantity is handled daily with less damage than when novices or hands out of practice are engaged.

When a power-driven picker is in use it is advantageous to place it in a central position in the field where the poles with the stacked peanuts can be transported bodily to the machine, resulting in less handling. With suitable uprights with a cross bar attached to the dray a lever with a grip attached to the top of the pole and passed over the cross bar would use it as a fulcrum, when the long end of the lever being lowered to the shaft would lift the pole entirely clear of the ground, allowing of its quick and easy transport to the picker.

The stems or vines of the plant, after the nuts are detached by the picker, can be stacked, baled, or chaffed and used for forage purposes, while the "dud" nuts (small or immature) can be fed to stock.

MARKETING

The nuts are usually bagged whole and shipped to the buyer, but where freights are high it is sometimes more remunerative to market the kernels only.

Special machinery is available to shell peanuts with a minimum of damage to the kernels. Bruising of the kernel at shelling or during transport is injurious, as decomposition is liable to set in and rancidity occur

Shelled kernels should also be absolutely dry before packing for the same reason. Each variety should be kept distinct, whether shelled or unshelled, as oil millers are understood to give lower prices when the kernels are of different colours.

DISEASES.

The peanut is seldom subject to disease when grown under proper conditions of soil and drainage. The most common disease noticed in Queensland is a form of leaf spot (*Cercospora* sp.) which appears as brownish spots on the leaves and is most frequent on sour or poorly drained land. When this appears late it will be possible with the upright growers to mow the tops and make hay before they are too far gone. Another disease that has been noticed on occasion is a kind of fungus attacking the stem where it enters the ground and is characterised by a cobwebby appearance, due to the mycelial threads of the fungus on the stem just below the surface, together with the appearance of minute round white or brown bodies the size of mustard seeds, which are the spore cases of the fungus. A proper system of drainage, together with liming and a rotation of crops, will minimise disease in the peanut as with other crops.

PESTS.

Insect pests are of infrequent occurrence, so far the only attack noticed in the State being odd instances of mealy bugs on occasional roots.

Vermin are very partial to the nuts, as are many birds outside those domesticated.

The duty recently imposed by the Commonwealth on peanuts and peanut oil is as follows:—On peanuts from the United Kingdom, 2d. per lb.; other British countries, 3d.; foreign countries, 4d. On edible oils, which include peanut oil:—From United Kingdom, 2s. per gallon; other British countries, 2s. 6d.; foreign countries, 3s.

The protection afforded by this tariff should compensate for the additional costs in growing under white labour conditions in Australia, and peanuts should become a staple crop in North Queensland.

YIELD.

The yield of the peanut crop will, of course, depend on the fertility of the soil, amount of rainfall, and attention bestowed.

While it will bear a satisfactory crop under a small rainfall, showing to an extent that it is drought resisting, it is not injured by excessive rains provided the soil is well drained. An instance of this was observed at Banyan in 1921, where a perfect sample of the Red Cross variety was seen which had experienced a fall of 120 in. of rain in the growing period.

Crops on a small scale have been estimated to produce 3 tons to the acre, and in the North field crops averaging 1 ton and over are not uncommon; but as a general rule, in satisfactory soils and under ordinary conditions with proper cultivation, 15 cwt. per acre might be expected as a fair average yield.

Where the crop grows to perfection, as at Cooktown and the Tableland, there is a fine opportunity for the institution of a co-operative oil mill and the purchase co-operatively of labour-saving machinery in picking, &c. In the growing of peanuts for marketing as whole nuts, it frequently happens that the product is not readily saleable owing to stained shells, glutted market, or other causes, when the presence of an oil mill will be advantageous.

The districts mentioned are in a particularly good position for the establishment of an oil mill, since freight on the whole nuts to the Southern parts is high and a ready market for the cake is to be obtained from the dairymen and pig-raisers near at hand.

THE PEANUT.

As a commercial crop the growth of the peanut in Queensland has not been favoured to any extent during past years, since, according to departmental statistics, the areas under cultivation and yields were:—1919: 153 acres; yield, 127,708 lb.; average per acre, 835 lb. 1920: 272 acres; yield, 274,916 lb.; average per acre, 1,011 lb. 1921: During these years the amount of nuts imported into Australia of various kinds, including peanuts but excluding almonds, was:—1919: 3,998,314 lb.; value, £96,056. 1920: 6,955,646 lb.; value, £271,087. 1921: 4,959,771 lb.

It is unfortunate that the peanuts, when imported, have been included with other edible nuts such as Brazil, Barcelona, walnuts, &c., so that accurate figures are not obtainable, but it is certain that a goodly proportion of the quantities enumerated can be credited to peanuts.

The imported unshelled nuts may be said to be wholly, and the Australian grown to be almost wholly, used for edible purposes in the parched form or in confectionery.

This use of the peanut, though it is capable of expansion, cannot be said to offer very great inducement to largely increased areas in the State; but when the other uses are considered there is every inducement to push the industry of peanut-growing forward.

A report, culled from the "American Trade Review," states that Professor Carver, Chief of the Research and Experiment Station at Tuskegee Institute, U.S.A., exhibited before the Ways and Means Committee of the House of Representatives at Washington, D.C., over 100 varieties of products from peanuts, including oils, milks, butters, flours, meals, breakfast foods, relishes, sauces, flavourings, many kinds of confectionery and prepared nuts, wood stains; different kinds of stock foods prepared from the nut and vine; and also a black ink and a face powder and face cream.

This is interesting as denoting the diversified uses of the plant; but at present the commercial uses may be briefly summarised as:—

The whole plant as a stock food either to be harvested, stored, and used as required or to be fed off;

The plant, exclusive of the nuts, cured as hay, in which it is close to lucerne in food value, and fed to stock;

The nuts for edible purposes, either whole, parched, or salted, or shelled, and used in confectionery;

The nuts for oil;

The residue after extracting the oil, in some cases, for edible purposes, but mainly for stock food or as manure.

The whole plant when used as a stock food has proved of great value in pig-raising either by being fed off or harvested and stored for use. With the upright or bunch varieties the tops are frequently mown for hay, and, after this has been carted off, the pigs turned in to harvest the nuts. Comment has been made on the effect of the nuts producing a soft pork, especially when such is the main diet. The addition of other foods, especially when topping off, should to a large extent overcome this. No difference can be noticed in the appearance of the peanut-fattened pig and one fattened on corn; and if the corn is not intended for bacon, no lowering in value need be expected. The foregoing applies mainly to crops fed off; but where the crop is harvested and the nuts or a portion marketed as such, no objection is raised.

In the form of hay, as the whole plant less the nuts is called when cured, the peanut affords a valuable fodder, which is rich in protein and rivals lucerne in feed value. The following analyses are instructive as a comparison between peanuts and lucerne:—

—	Total Dry Matter.	DIGESTIBLE NUTRIENTS IN 100 LBS.				
		Crude Protein.	Carbo-Hydrates	Fat.	Total.	Nutritive Ratio.
Lucerne	91·4	10·6	39·0	0·9	51·6	1 3·9
Peanut Vine	78·5	6·6	37·0	3·0	50·4	1 6·6
Peanut Vine with Nuts	92·2	9·6	39·6	8·3	67·9	1 6·1

In palatability, probably the peanut hay is ahead of lucerne, as stock greedily eat the hard, sun-dried stems no matter how long exposed.

In feeding the hay or the whole cured plant to horses and cattle, the receptacle should allow of any soil adhering to the roots falling through; and the danger in feeding mouldy peanut hay is the same as with mouldy hay of any other kind.

The nuts as used for edible purposes are familiar to all, and, before the plague restrictions, were probably most familiar to the frequenters of music-halls and picture-shows.

Washed or brushed nuts with a clean, bright shell are naturally sought for this trade, the larger nut being most in demand—not that it is more palatable, but probably because being larger, and the berry not so full, it is easier shelled; still another reason is that, bulk for bulk, it is lighter than the bunch nut, and being sold by measure goes further.

Prepared for sale as whole nuts, the process is either to salt or to parch by exposure to a fairly high temperature without, however, scorching the shell.

In confectionery, the peas or kernels only are used, and are first blanched by removing the thin outer skin and degermed. They are used in place of almonds as icings, toffees, rocks, and in other ways too numerous to mention.

The blanched and degermed berry is also roasted and ground to make peanut butter, salt being added to flavour. See "Queensland Agricultural Journal," February, 1921, page 77.

The chief value of the peanut is as a source of oil; and this oil is the most important of the world's food oils. In past years the production of peanuts was largely confined to India, China, and other tropical parts of Asia; but now large acreages are planted in Africa and America. As illustrative of one country's increase in production, the average annual export of the British colony of Nigeria during the five-year periods ending 1905, 1910, 1915, and 1920 was 513 tons, 1,572 tons, 9,778 tons, 48,500 tons; the greatest quantity shipped in one year being 57,554 tons (Bulletin Imperial Institute Vol. XIX No. 2). In the south of the United States, peanuts first became commercially important in the year 1870, and gradually increased in importance up to 1900; since when the industry has expanded enormously. In 1889 only 3,588,143 bushels of nuts were produced (U.S. standard bushel = 22 lb.). The production increased to 12,000,000 bushels in 1911, and to over 40,000,000 bushels in 1917, in which year the area under crop was over 2,000,000 acres. Up to 1914 peanut oil was not imported or produced to any considerable extent; but, in 1916, 2,000,000 gallons of the oil were imported and 3,488,649 gallons were produced in the country, mostly from the shelled nuts (Year Book, U.S. Department of Agriculture 1917).

In France, at Marseilles, enormous quantities of peanuts are imported, both whole and hulled, from which many millions of gallons of oil are expressed, something like an average of 40,000,000 gallons being produced yearly, prior to the war.

Peanut oil in bulk is known to the trade as China oil.

Under this heading Commonwealth imports are given as in 1919: 107,742 gallons, valued at £34,215. 1920: 47,820 gallons, valued at £20,276. 1921: 58,966 gallons.

The finer grades of oil are included with various other vegetable oils in small containers, and the quantity cannot be arrived at; but the total values of this class of oil imported were—In 1919, £28,327; and 1920, £36,502.

The total values of the importations is not very great; but the various uses to which the oil can be put would create a market, if locally produced, far in excess of these figures.

Amongst the uses of the oil are—Finest oil as salad oil and for use in medicine, the arts, and as a lubricant for high-speed journals in delicate machinery, &c.; first quality grade for cooking, and in the manufacture of margarine; also as a lubricant and harness-dressing, &c.; lowest quality grades for soap-making and other industrial purposes.

Peanut oil is generally used in the cooking of sardines and other fish sold in oil, as olive oil will not stand the high and continuous heating necessary: The fish are first cooked in the peanut oil; then drained, put in cans, and the cans then filled with olive oil. For much the same reason peanut oil is preferred by cooks to olive oil in other branches of cookery. The oil is also becoming popular with manufacturers of lard substitutes, who harden the oil by hydrogenation.

The extraction of the oil from the nuts is a simple process, and entails less procedure and machinery than other oil-products. The bulk of the oil is obtained by simple pressure, and the balance on heating and again subjecting to pressure.

In the United States more attention has been paid to special machinery for the expression of peanut oil than elsewhere, though cotton-oil mills have in many cases been adapted for the purpose.

The "Expeller" system, it is claimed, reduces the amount of machines to a minimum; the one machine extracting the oil in two operations—one cold, and the other after heating the residue from the first pressing. Other systems require the nuts to go through a series of crushing-rolls first, and then through hydraulic presses, when, the first oil being expressed, the meats are broken up, heated, and pressed a second, third, and sometimes a fourth time.

In preparing the peanuts for oil expression, they are first put through grading and cleaning machinery to get rid of unfilled nuts, dirt, and other foreign matter.

The nuts may be treated either whole or shelled, the latter always being the case when the highest grade oil is required. Special machines are in vogue for shelling, blanching, and degerming.

When preparing for high-grade oil, the shelled kernels are passed over a picking-table on a slowly moving belt, alongside which are seated operators who pick out any trash or bad nuts not removed in the previous cleaning process.

The blanching process consists in removing the thin skin covering the kernel. This skin contains about 13 per cent. of oil, and is included with the material when expressing the lower-grade oil. The blanching machine consists of a set of brushes revolving against a corrugated plate. When most of the skins are removed, the kernel separates into halves, and the germ becomes loosened.

The meats are then separated from the skins and germs by passing them over screens in front of a fan. The skins are blown out, and the germs fall through the screen, which should have round holes about ¼ in. in diameter. The germ is added to the material for lower-grade oils, as the oil it contains is of lower quality than that of the rest of the kernel.

From the blanched degermed kernels the highest grade of oil is obtained; this is practically colourless and inodorous, possessing a pleasant, nutty flavour, which commends it as a salad oil. In certain cases the oil is further refined by passing it through charcoal filters.

The various grades of oil command prices according to their degree of purity. Oil expressed from whole nuts may be refined; but the highest degree of purity is obtained as outlined in the expression from shelled nuts.

The presence of damaged kernels will lower the quality of the oil. For ease of transport, nuts are frequently shelled before marketing, and, unless thoroughly dry, are apt to heat, causing the presence of a free acid in the resultant oil. In analysis this is expressed as an acid value, being the number of milligrams of caustic potash required to neutralise the acid in one gram of oil.

The resultant cake or meal after the expression of the oil from the shelled nuts is used for the preparation of human foods as meals, flours, and breakfast foods, &c., and also as with the cake formed in the treatment of the whole nuts as a stock food or fertiliser.

An average analysis of peanut oil cake shows, according to Henry and Morrison:—

	Total dry matter in 100 lbs.	DIGESTIBLE NUTRIENTS IN 100 LBS.				Nutritive Ratio.
		Crude Protein.	Carbo-Hydrates.	Fat.	Total.	
From whole nuts ..	94·4	20·2	16·0	10·0	58·7	1 1·9
From shelled nuts ..	89·3	42·8	20·4	7·2	79·4	1 0·9

The feed value of these products is at once apparent, and, viewing the richness in protein as evidenced in the nutritive ratio, it becomes most valuable as a concentrate for addition to stock foods in making a balanced ration.

For oil production the bunch or upright varieties are favoured, especially the Red Cross. These varieties, having an upright growth, also lend themselves to a mowing of the tops, and, as well as being easier harvested, yield a heavier crop of nuts than the creeper or procumbent varieties.

A MARKET FOR PEANUTS.

One of the objections, from the producer's point of view, to the peanut as a crop has, up to now, been the impossibility of disposing of the culls—that is, the small, broken, discoloured, and shrivelled nuts unfit for either the roasting or confectionery trade; but this has been overcome now by the establishment of an oil mill at Marrickville, Sydney, which will provide an outlet for these culls, which can be used for oil crushing.

The price for oil milling nuts will naturally be world's parity, as otherwise it would be impossible to successfully compete with imported oil. It is realised that the world's parity price for milling nuts for the whole of the growers' crop would not be a paying proposition to the farmer, and to ensure a full return to the producer the milling company will receive locally-grown nuts, which will be graded for (1) confectionery trade, (2) roasting trade, (3) culls, which will go to the mill for oil crushing.

The Australian-grown nut must compete with the Chinese nut, which arrives here perfectly graded and nearly 100 per cent. usable for the purpose for which it is bought; consequently the successful marketing of the local nut depends entirely on the establishing of a grading house for handling the nuts on the lines indicated above.

The Australian grower is very handsomely protected with a tariff of 4d. per lb. for peanuts in the shell and 6d. per lb. for peanut kernels. In the United States, America, the peanut industry has grown into huge dimensions, competing successfully with the Chinese nut on a protective tariff of three-eights of a cent. per lb. on nuts and three-quarters of a cent. per lb. on kernels. The American tariff, as compared with the Australian tariff, is as follows:—Peanuts in the shell: America, £1 14s. 6d. per ton; Australia, £37 6s. 8d. Kernels: America, £3 9s. per ton; Australia, £56. The effect of the heavy Australian duty has been to curtail the sale of peanuts. There was at one time a big trade for children's "penny bag" peanuts, but the small quantity which can now be purchased at this figure is not attractive. If the Australian grower takes the full advantage of the tariff protection, this state of affairs will continue. The nuts will be graded by the company into (1) confectionery, (2) roasting, (3) milling. The advantage of the protective tariff can only be looked for on grades 1 and 2, as the price of milling nuts will be regulated by world's parity and the local price of imported oil. Even in the milling grade the Australian grower will have the advantage in price over imported nuts to the extent of the freight, &c., from outside markets.

To obtain the best results—that is, a high percentage of confectionery nuts—the farmer should make certain that the soil, climate, and rainfall are suitable and proper methods of cultivation adopted. Advice on these points can be obtained from the Department of Agriculture. Another point of importance is the selection of a variety and type of nut suitable to the district, and the class of trade for which the grower proposes to cater. For the roasting trade the large nut known as the China is most suitable. The Valencia nut, which is not quite as large as the China, but carries almost as big a kernel, is most suitable for the confectionery trade, while the variety known as the Spanish is the best for milling, as it contains a very high percentage of oil, and the crop from this variety is the more prolific. This nut, owing to its flavour, is also fast growing in popularity with the confectionery trade.

The plant installed at Marrickville is capable of handling 2,000 tons per annum, but with slight additions the capacity can be doubled. The principal objection to the peanut crop—that is, the impossibility of disposing of the culls—is, through the establishing of this mill, now overcome, and the crop should be well worth the consideration of farmers where the soil and climatic conditions are suitable.

REINFORCED CONCRETE TANKS.

SPECIFICATION FOR CONSTRUCTION ABOVE GROUND.

Excavation.—Excavate for floor of tank as shown. Excavation to be cut to the neat dimension and surface well tamped to form a solid foundation. Any filling-in required is to be done with broken stone tamped so as to form a solid foundation.

Reinforcement.—The reinforcement for floor and sides should first be put together and the reinforcement for top of tank prepared so that it can be put on immediately plastering of walls is near completion. Floor reinforcement to be placed as shown, about three-quarters (¾) inch from underside of concrete bottom of tank. Then place expanded metal all round sides of tank, fixed horizontally to light skeleton framing and locked according to manufacturer's directions. All this reinforcement is to be securely bound together with number sixteen (16) gauge wire so as to form a rigid frame. Reinforcement in top of tank to consist of expanded metal in single lengths across top of tank, locked together as before, cut and bent over into sides of tank and wired together. Form circular manhole as shown. Remove skeleton framing before inside plastering is commenced.

Temporary centring of three-quarter (¾) inch boards is to be used to support top until cement is set.

Concrete Floor.—Floor of tank to be of concrete five (5) inches thick. Concrete is to be composed of four (4) parts stone, broken to pass through a three-quarter (¾) inch ring, two (2) parts clean sand, and one part Portland cement. It shall be mixed on a wooden platform, turned over twice (2) dry and three (3) times while water is poured on, and thoroughly incorporated, and must be used quite fresh. Concrete to be well settled around reinforcement and the whole floor well tamped.

Cement Plaster.—Walls and top of tank to be formed of cement plaster one and a half (1½) inches thick, composed of one (1) part cement to two (2) parts clean sharp sand. Care must be taken in mixing the plaster to make it of the exactly right consistency, as no cement or sand must be added for drying and no water added for moistening whenever the plastering is commenced.

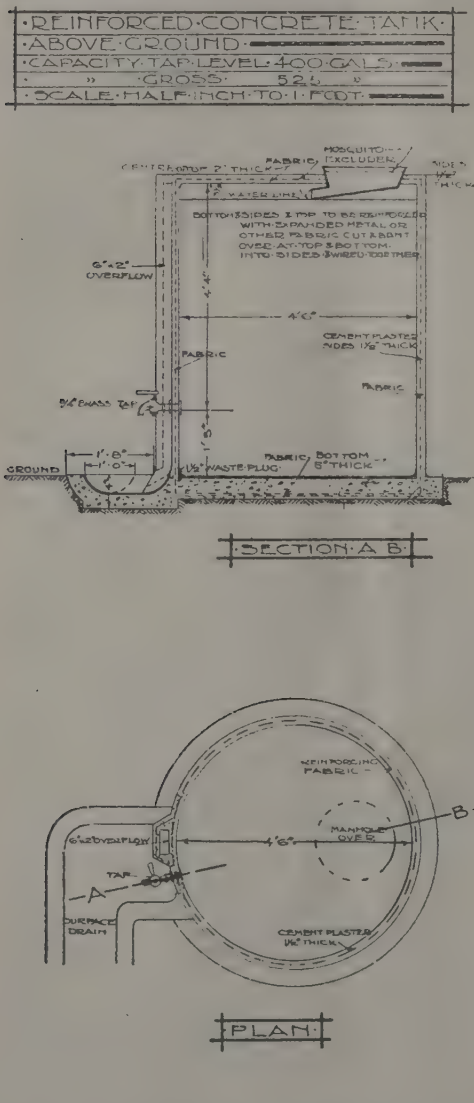
Render the floor of the tank with cement similar to the above three-quarter (¾) inch thick.

NOTE.—Top of tank to be two (2) inches thick in centre, weathered to one and a-half (1½) inches at sides.

Waterproofing.—All concrete and plaster to be mixed with "Toxement" or other good waterproofing compound, mixed to manufacturer's instructions.

Construction of Tank.—The concrete and cement portion of tank must be completed in one operation, and no initial set must be allowed to take place in the cement before any unfinished edge of plaster is carried on. The holding capacity of the tank depends entirely upon the tank being made monolithic, and the importance of this must not be neglected. The concrete floor should be started immediately on commencement of work in the morning. As soon as the floor is laid the plasterers must start, so that the junction between wall and floor shall be continuous. As many plasterers as can conveniently work must be put on, working together inside and outside the walls, and care must be taken that the cement is well filled into the reinforcement. As soon as the walls are completed to the top of the tank a layer of cement is to be placed upon the centring and the expanded metal for top, which should be ready for

immediate use, must be placed, and the top of the tank plastered as before. The whole of the plastering shall be completed in one operation and worked to a smooth and even surface inside and out, and all angles should be rounded or filletted.



Overflow.—Provide collapsible core from overflow of two (2) inch pine in three (3) pieces wedge-shaped, and remove same when concrete is set. Care to be taken that parts of core to be withdrawn from lower part of overflow be so made that they will easily pass through hinged flap. Leave opening in top of tank, both in concrete and expanded metal, about six (6) inches diameter, with bevelled edges, immediately over overflow, so that upper part of core can be withdrawn. Fill in opening flush when core has been removed. Build in galvanised iron frame and hinged flap at bottom as shown.

Tap and Cleaning Plug.—Provide and build in, where shown, a three-quarter (¾) inch low pressure brass tap, also one and a-half (1½) inches diameter cleaning plug. Tap to be fixed in position before plastering is commenced, and plaster worked up close all around same where it passes through wall of tank. Pipes passing through

walls of tank to be threaded full length. Put circular metal washer on outside under tap and cap to clean out pipe, and screw up tight.

Mosquito-proofing.—Provide and fix mosquito-excluder to manhole in tank.

Drain.—Form drain under tap as shown and properly connect to surface drain.

Keeping Damp.—Keep the whole of the concrete and plaster walls damp, both inside and outside of tank, for at least fourteen (14) days after completion, keeping tank well covered with old sacking during that time.

Removing Centring.—Remove centring at the same time that sacking is removed.

NOTE.—All centring, especially core for overflow, to be given a good coat of soft soap before plastering is commenced.

Cleaning out.—Thoroughly clean out the inside of the tank at completion.

SPECIFICATION FOR CONSTRUCTION UNDER GROUND.

Excavation.—Excavate for tank as shown on drawings to neat dimensions with clean cut sides and well tamped at bottom to form a solid foundation.

Bottom of excavation to be level and sides plumb and free from loose earth.

Concrete Work—Materials.—

Sand.—To be first quality fresh water deposit, sharp and coarse; clean and wash if necessary so as to be free from all impurities.

Gravel.—To be best river gravel procurable or clean broken hardstone to pass through three-quarter (¾) inch gauge and free from dust and all other impurities.

Water.—To be clean and fresh.

Portland Cement.—To be of the best quality.

Waterproofing.—All concrete and rendering to be mixed with "Toxement" or other good waterproofing material, mixed to manufacturer's directions.

Concrete.—To be composed of four (4) parts of gravel or broken hardstone to pass through three-quarter (¾) inch mesh to two (2) parts of sand to one (1) part of Portland cement.

Mixing.—The concrete is to be mixed upon a platform and the aggregates accurately measured as above.

The sand, gravel, and cement to be spread in layers upon the platform and mixed three (3) times dry or until of a uniform colour and to be turned over three (3) times while the water is being applied, which is to be poured on slowly and with care, and the whole thoroughly incorporated. Concrete after mixing is to be used at once. Well ram as the work proceeds, and the whole to be left with a smooth level surface.

No concrete which has once taken its initial set shall be worked up or used again in the works.

All concrete to be protected and kept free from dirt.

Casing.—Provide casing for walls and top of one (1) inch boarding well strutted and laid with close joints and well wetted before depositing the concrete.

Reinforcement.—To be of expanded metal or other good fabric and locked together according to manufacturer's directions and securely bound together with number sixteen (16) gauge wire so as to form a continuous and rigid frame throughout. Top and bottom fabric reinforcement to be bent up or down and tied to that of sides.

The fabric reinforcement to be placed in walls two (2) inches from outer face of walls and one (1) inch from underside of top and bottom, as shown, and to be temporarily blocked out to keep in position while concrete is being filled in, all blocks being removed as the concrete is laid.

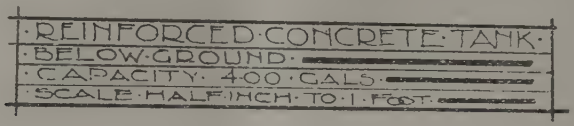
Concrete Work.—The sides and top to be three (3) inches thick and the bottom five (5) inches thick, with sinking to centre as shown.

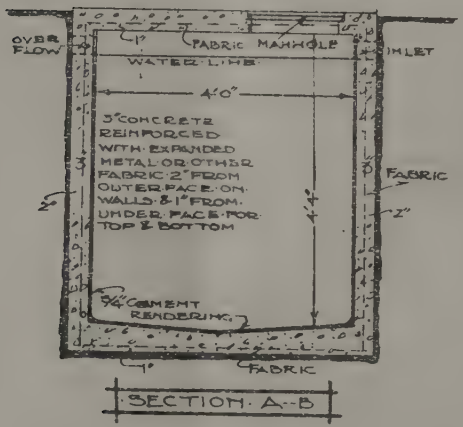
The bottom to be laid first and well tamped. The junction of walls and bottom to be continuous and the sides to be filled in twelve (12) inches layers and spread and settled around and through reinforcement and carefully tamped as the work proceeds.

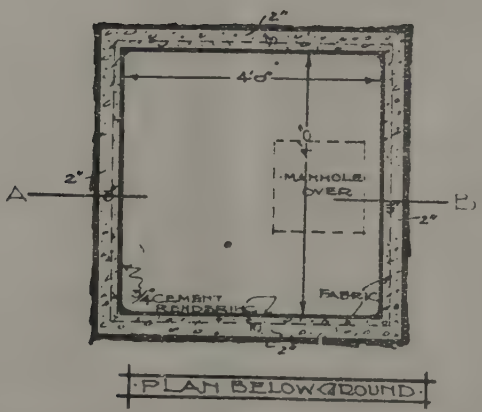
The top to be laid on centring with one (1) inch layer of concrete; the reinforcement fabric is then to be placed in position and tied, and the remaining two (2) inches of concrete to be carefully laid.

The work should be continuous, as the tank should be monolithic. Should it be necessary to stop work so that concrete sets, when recommencing work the existing bed of concrete shall be brushed perfectly clean, well watered, and grouted with equal parts of cement and sharp sand.

Rendering.—Render the whole of the sides and bottom as shown while the concrete is green with mortar composed of two (2) parts sand to one (1) part of Portland cement and three-quarter ($\frac{3}{4}$) inch in thickness, finished to a good smooth surface with steel trowel, all angles to be rounded or filletted.







Manhole.—Form rebate in top for manhole and fill in with cast-iron manhole cover with lock and key.

Inlet, &c.—Set pipes for inlet and overflow as the work proceeds.

Keeping Damp.—Keep the concrete top damp, covering with wet bags, for at least fourteen (14) days after completion.

Removing Centring.—Remove centring fourteen (14) days after completion of the top.

Clean out.—Thoroughly clean out the inside of the tank at completion of work.

THE ALGAROBA BEAN (*PROSOPIS JULIFLORA*): IS IT LIKELY TO BECOME A PEST?

Mr. J. Locke, of Mackay, writes questioning the value of the Algaroba tree as a fodder plant, and suggests that, as such, it is much overrated. *Inter alia*, Mr. Locke says:—"In 1915 I procured some seeds of this so-called king of all fodder plants. The seeds germinated freely, and I transplanted half a dozen young trees, which have since flowered and borne crops of beans. The trees bristle with thorns, and it is almost impossible to pick the beans from the boughs in the centre of the bush. After the beans are gathered they must be dried and then ground in some machine. Upon consideration it will be apparent that the cost of labour involved by all these operations is more than the value of the product. As a fodder plant the Algaroba will not bear comparison with many cereals or legumes, and as a standby in time of drought its value when compared with ensilage is infinitesimal. As a pest, if it gets a grip of our rich scrub lands it may become as great a curse as lantana or prickly-pear. I write to sound a note of warning and advise intending planters to exercise caution when buying these much advertised novelties, which are often not worth the care bestowed upon them. Certainly the Algaroba has been tried and found wanting."

In this connection it is interesting to note that the Government Entomologist and Plant Pathologist (Mr. Henry Tryon) some time back addressed the following letter to the Under Secretary, Department of Agriculture and Stock:—

"This tree has been pronounced to be 'one of the most valuable sources of feed in Hawaii,' alluding to its place amongst leguminous forage plants. It is one of the mesquite trees and was formerly introduced from Mexico in order primarily, it is understood, to clothe the more arid portions of that region, and so induce rain, or obviate the too rapid loss of such as had already fallen. From my personal observations of the habits of the Algaroba, both in the Hawaiian Islands and in the part of North America from which it originally emanated or nigh thereto, I have come to the conclusion that it is likely to become a serious pest anywhere where its employment is not essential for the purposes alluded to—as appears to be the case in regard to Queensland. Its habit where growing spontaneously (and it most readily becomes naturalised) is to form a veritable thicket of an impenetrable character, to the exclusion of other vegetation or useful vegetation. How widely it may become disseminated will appear from the fact that it is the beans or pods of the tree, on falling to the ground and where accessible, that cattle almost exclusively consume. For on consuming them they do not digest the seed, but pass it out with their droppings, to be just in the condition favourable to its germination. (This, of course, does not apply to the use of the pods by dairymen and livery stable men, who pick up the small pods from under the trees for the purpose, first kiln-dry them and grind them, seeds and all.) However, 'when milch cows are fed on Algaroba milk consumers complain of a bad flavour in the milk' and 'in some cases bowel trouble in children has been attributed to the feeding of the Algaroba (to cattle) by dairymen' (C. K. McClelland)."

The matter being referred to the Government Botanist (Mr. C. T. White, F.L.S.), that officer replied as follows:—

"In importing foreign plants for either æsthetic or economic purposes, it is well to take into consideration experiences in other parts of the world with the particular species imported. It must be remembered that quite a number of our pests were imported for definite purposes—thus, the lantana, billy goat weed or bluetop, and water hyacinth were imported as garden plants, while the prickly-pear and wait-a-while or hold-me-back (*Cæsalpinia sepiaria*) were introduced as hedge plants.

"In regard to the Algaroba, J. F. Rock, the leading authority on the plants of the Hawaiian Islands, states that 'No tree so far introduced has proved of such enormous benefit to these islands as the Algaroba . . . . all the waste lands which previous to the introduction of this tree were absolutely barren are now covered by green forests made up exclusively of this tree.' In the Hawaiian Islands its principal use has been to cover large previously treeless mountain areas and so prevent soil

erosion and the too rapid loss of rain that had fallen; its use as a fodder-tree plant, firewood, and tanbark are probably secondary values.

"In the southern United States, where the plant is a native, opinions are not so definite on its value. There its value is particularly confined to its use as a fodder, and in this connection J. S. Smith, in Bulletin No. 2 of the Division of Agrostology, U.S. Department of Agriculture, states:—'It is the most common tree of the mesas of the South-western United States, and because of its many uses is an exceedingly valuable species. Experiments in a small way have been made to preserve the beans for winter feeding, with partial success only, because of a small weevil that bores into them after they are gathered and renders them unfit for stock feed. One acre of land well covered with mesquite trees often produces not less than a hundred bushels of the beans per annum. The mesquite bean is looked upon by some as a curse and by others as a blessing. The trees are spreading with great rapidity since prairie fires are no longer set to keep this and other weedy plants in bounds. Within the last twenty years the mesquite bean and the prickly-pear have covered many square miles of land in Texas which was formerly open prairie. There is no doubt that the amount of grazing has been diminished by the spread of mesquite brush. On the other hand, the beans are of decided value in times of drought, when grass is scarce. It is probable that the mesquite bean is now of less value than formerly, before it was known that alfalfa could be successfully grown for winter feed or the hay used in times of drought.'

"Writing in the same series (Bulletin No. 10) on the grasses and forage plants of Central Texas, H. L. Bentley states:—'As, bushel for bushel, they are quite as valuable for feeding stock as cow peas, it will be seen that for forage purposes the mesquite tree is an important factor in this section, where there are millions of them.'

"From the foregoing it would seem the greatest danger from this tree would be from its spreading over areas carrying valuable native grasses, as in the Central, Northern, and Gulf districts, where it might crowd out the native grasses and herbage and so lessen the carrying capacity of the land, in somewhat the same way as the *Parkinsonia* tree has done in various parts of Western Queensland. The dry scrubs in the Central district, as those in the neighbourhood of Rockhampton, are also places where the tree might possibly get a hold in somewhat the same way as the lantana already has in many places.

"It is comforting to know, however, that the tree has been in Queensland for a number of years without showing signs of becoming a pest in any way, for seeds were first introduced in 1877 and the tree was bearing pods at Kamerunga State Nursery over twenty years ago. On the whole, the advantages derived from the tree would appear to outweigh the disadvantages, but it would be as well to keep a sharp lookout to see that the tree is not spreading too rapidly, to the detriment of better vegetation.

"In planting trees for fodder for use in times of drought we have, in my opinion, in many native sorts species better than the imported, as, for instance, the kurrajong (*Brachychiton populneum*), red ash (*Alphitonia excelsa*), Mulga (*Acacia aneura*), cattle bush (*Pittosporum phillyræoides*), supple jack (*Ventilago viminalis*) and others. The value of these trees should not be overlooked in any scheme of planting trees as emergency feed in times of drought."

CUTWORMS.

By N. A. R. POLLOCK, Northern Instructor in Agriculture.

In experimenting in disease control with tomato plants at Bowen, part of the treatment was to dip the roots and stems of the plant, after lifting from the seed bed in a solution of 1 part sulphate copper (bluestone) to 500 parts water (a heaped teaspoonful of the powdered bluestone to 3 pints of water is near enough). It was noticed that while plants set out without this treatment were often lost by being eaten off at the ground by cutworms or other insects, no instance was noticed of attack being made on a treated plant. Possibily this experience may be of value to growers who suffer loss when setting out other plants..

It is important to keep the leaves free from the solution.

REINFORCED CONCRETE TANKS.

For the article appearing on pages 267-270, the specifications and plans were prepared and courteously supplied by officers of the Department of Public Works, Brisbane, in response to a subscriber's request referred to them.

COTTON.

By H. C. QUODLING, Director of Agriculture.

Cotton is not by any means a new crop to Queensland. Its cultivation commenced here in 1860, and ten years later the area cropped had increased from fourteen to upwards of fourteen thousand acres. The origin of cultivation and this increase was brought about by two contributory causes—a bonus on cotton, and an extraordinary demand due to the American Civil War. The re-appearance of American cotton in the European market on the conclusion of the Civil War, and the difficulty in those days of communication with Europe were the principal factors in a decline in the area cultivated, and which continued until 1887.

The industry was resuscitated soon after and manufacturing undertaken on two separate occasions at Ipswich, but operations in this direction were not at any time very extensive. Cessation on the last occasion was due to competition from abroad, there being no protective duty.

Low prices over a term of years acted as a check to development. Added interest was shown in the crop in 1903, and in 1913 the Government made an advance of 1½d. per lb. on seed cotton and ginned it on owner's account, the final return being equal to about 1¾d. per lb. The system of making advances to farmers has since been continued. Last year, and again this year, the advance was 5½d. per lb., and the same rate will be maintained until 30th June, 1923.

The present Government has throughout shown great interest in the cultivation of cotton, and the advance of 5½d. per lb. is due to their desire to encourage the farmers to cultivate this crop with the sure knowledge of a market, thus establishing the industry.

Extraordinary interest is now shown in the crop, which has proved most remunerative; in fact, many farmers now engaged in cotton-growing had not hitherto been so prosperous.

The active participation by the Australian Cotton Growing Association (Queensland), which has established modern ginning plants at Rockhampton and Brisbane (Whinstanes), has also contributed to the flourishing condition of the industry. An assured price of this character, even should it be regulated at a later date, according to a sliding scale consistent with varying qualities of cotton, is calculated to do much towards the extension of what promises to be a very important industry to Queensland. The 1921-22 crop promises to exceed a total of 1,500 tons of cotton in seed, and a big increase is expected for 1922-23.

Efforts are being directed by the Department towards the introduction into cultivation of improved long staple Upland varieties, with a view to the production of cotton which will return a good aggregate yield, and command also the highest possible price obtainable.

A sub-tropical climate, copious rains in the spring and early summer, followed by a dry autumn, are favourable conditions for the development of the cotton plant.

Upland cotton should be grown as an annual crop and in rotation, wherever possible, with other suitable crops.

DIRECTIONS FOR PLANTING UPLAND COTTON.

Cosmopolitan Character of Plant.—Under favourable climatic conditions cotton will thrive on a great variety of soils. A naturally well drained soil should be chosen.

Drought Resistant Habit.—The plant is a deep rooter and naturally drought resistant once it is firmly established, but responds to good cultivation, and will return heavier crops on cultivated land where the surface soil has been thoroughly prepared some months beforehand, and moisture stored up in the sub-soil and conserved by regular cultivation for the use of the growing crop.

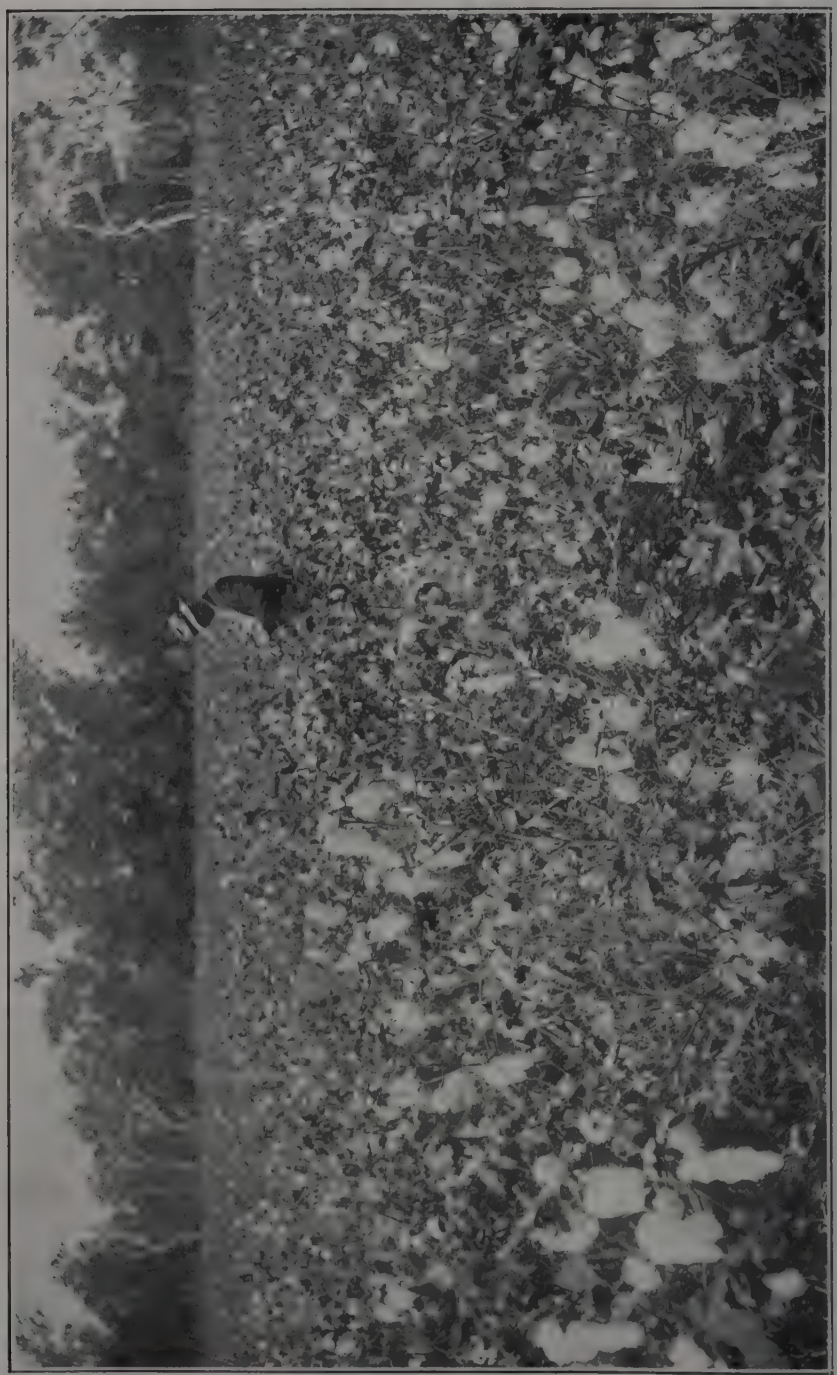


PLATE 56.—CROP ON MESSRS. IRELAND'S PLANTATION, ALMA CREEK, DAWSON VALLEY.

PLATE 57.—COTTON CROP ON MR. J. L. W. JENSEN'S FARM, WOWAN, DAWSON VALLEY—FIVE ACRES PRODUCED TWO TONS AT THE FIRST PICKING.

Well Prepared Land Essential.—Land that is ploughed and cross-ploughed, not necessarily deep, say to a depth of six or seven inches, should be worked up to a good tilth on the surface prior to the seed being sown. In this way germination is assisted, and a supply of plant food made readily available.

A Good Crop for Scrub Land.—Cotton is a suitable crop for and thrives well on recently burnt off scrub land, amongst the stumps and unburnt logs, the seed either being planted by hand in a shallow depression, not more than an inch and a-half deep, made and covered in again with a hoe, or else put in with an ordinary maize "hand planter."

Where practicable, parallel dray tracks should be cleared at intervals, say every two chains, throughout the field, to facilitate the removal of the picked cotton at harvest time, the stumps along the tracks being cut off close to the surface of the ground to facilitate the passage of dray or other conveyance used.

Judgment should be used when planting seed to keep it in fairly straight lines or rows, which may vary in width, say between 4 and 5 ft. apart, according to the conditions under which the cotton is grown. The seed is customarily sown in closely spaced hills 15 to 20 in. apart along these rows, two or three seeds to a hill, thinning to a single, strong, vigorous plant when the plants attain a height of about 6 to 8 in.

Where the surface is rough, or encumbered with logs or stones, wider and more irregular spacing of hills is necessary; allowance being made in this instance for plant development and room to move amongst the plants at harvest time.

On the other hand, where there has been a clean burn, close and continuous planting is permissible, in order to approximate the final distances apart of plants aimed at, when cotton is grown on cultivated land.

The Cotton Crop as an Adjunct to Dairying on Scrub Land.—Where recently burnt off scrub lands are required soon afterwards for dairying purposes, cotton may be grown, under favourable conditions, as a primary crop, and Rhodes grass seed sown, say at the rate of 4 to 5 lb. per acre, throughout the growing crop, when the young cotton plants are established. Planting of the grass seed should be regulated to fit in with the wet season, and to allow time for the grass to establish itself before the winter. If sown too early, the grass would smother up the cotton plants, and tend to reduce the yield of cotton.

Amount of Seed per acre and Distances between Rows on Cultivated Land.—About 10 lb. of seed are sufficient for an acre, when care is exercised in planting. Rapid and economical planting is assured by the use of a two-row maize or cotton planter.

Rows 4 feet Apart.—This is a fair average distance between the rows, but this width should be increased under special circumstances, as described. Where a single-horse maize drill is used for planting the seed, very light furrows may be run out 4 ft. apart with the plough and the seed drilled in the furrows; or *preferably* a marker may be used, marking three rows at a time, as a guide when sowing for the person who uses the drill. Prompt harrowing immediately after either of these operations is necessary.

Rows 4 feet 6 inches Apart.—On good agricultural land, where vigorous growth is expected, the rows may be 4 ft. 6 in. apart, and the plants left to stand 12 to 15 in. apart in the rows.

Rows 5 feet Apart.—When arranging for planting on rich land, where forcing conditions may be expected during growth, an allowance must be made for the extra size attained by the plants. Here the rows may be 5 ft. apart, but the plants should be crowded in the rows and left at from 12 to 15 in. apart at the final thinning.

After Cultivation.—Early and constant use of the horse hoe (the later the cultivation the shallower it should be) is necessary to keep the weeds down, and the soil in a well aerated condition. In this way the plants can be carried over any dry spells.

On Scrub Land.—The use of the hand hoe on scrub areas will also be conductive to heavier yields and healthier crops.

Distances between Plants in the Row.—Judgment is to be used in all plant spacing. A good average planting space between the single seeds and the young plants grown therefrom is from 8 to 10 in. It is necessary, however, to thin these out when they are several inches high.

In dry districts, one strong plant should be left at intervals of from 15 to 20 in. Emphasis is placed on the fact that on rich soil, when the season is good, plants require to be kept close together in the rows, say 12 to 15 in. apart.

In Upland cotton, if the spaces between the plants in the rows are at all wide it induces the formation of "vegetative" (woody) branches to the detriment of the "flowering" (bud and boll bearing) branches, and a consequent reduction in cropping capacity.

PLATE 58.—COTTON CROP (20 ACRES) ON MR. L. SMITH'S FARM, DULULU, DAWSON VALLEY LINE.
Yield.—1,200 lb. per acre to date (picking not complete).

PLATE 59.—DRYING THE COTTON, BEFORE BALING, ON MR. L. SMITH'S FARM, DULULU, DAWSON VALLEY LINE.

PLATE 60.—DRYING THE MORNING PICKING ON MR. C. G. YOUNG'S FARM, DEEFORD, DAWSON VALLEY.

PLATE 61.—BALING COTTON AT MR. C. G. YOUNG'S FARM, DEEFORD, DAWSON VALLEY LINE.
(Note improvised dumping appliance).

PLATE 62.—COTTON FIELD ON MR. C. H. CHOWN'S FARM, WOWAN, DAWSON VALLEY.
Miss Chown made the record picking of 170 lb. seed cotton in one day.

PLATE 63.—REFRESHMENTS IN "DIXIE" LAND—MR. H. WENCKE'S FARM, MYRTLEVALE, WOWAN, DAWSON VALLEY LINE.

Treatment of Seed.—Owing to the short fluffy fibres adhering to the seed, it must be treated prior to attempting to pass it through a drill or maize hand planter. Puddled clay or flour paste is commonly used for this purpose. Seed is dipped, in small quantities, into a vessel containing either of the above mixtures, the best consistency for which is readily ascertainable by a little practice. That treated with puddled clay should be rolled by hand on a sieve or other suitable surface, and the seeds made up to resemble small marbles, which must be allowed to dry out in the sun; when drying out, careful handling is necessary.

The flour paste treated seed is dipped into the prepared paste, drained, and well squeezed, but care should be taken at once to prevent the seeds sticking together. Ashes are useful in this latter respect, but the seeds should be carefully separated and dried out on bags or on a tarpaulin to ensure their regular and easy passage through the seed drill.

The fluff on the seed may also be singed. For this purpose a dry hollow log 3 to 4 ft. in length is stood up on iron bars over a tub of water. The inside of the log is fired, and the seed dropped through in a thin stream from the top directly into the tub of water, and dried out immediately after, so as to be ready for use.

Time to Plant and Period of Maturity.—Other things being favourable, the time for planting seed varies according to climatic conditions ruling in any particular district, and planting may be carried out as soon as danger from frost is over, up to October, and in some localities to mid-December. Under satisfactory growing conditions the first flower buds appear when the plant is about forty days old. It takes about another thirty days for the flower to expand. The flower remains open for about three or four days and drops off, changing to a richer colour before doing so. The boll increases in size for about fifty or sixty days, and then bursts open, through the growth of the cotton lint enveloping the seed. Development and expansion of the fibres follow on in natural sequence until the full, fluffy boll of lint completes the process of development of the cotton.

It is inadvisable for a crop to mature during the summer rainy season. The dry, fine, hot weather customarily following on immediately after this period is the best kind of weather for the plant to complete the bearing and maturity of its crop of cotton. Obviously, soils which are of a loamy or of a sandy loam character, and are of good capillarity, will not suffer so much from dry weather as those which are liable to crack or fissure. It is at this late period in the life of the growing plant that reserve supplies of soil and subsoil moisture are drawn upon in order to fully develop its crop.

On good, rich agricultural land, in moist, warm weather, the cotton plant has an inclination to make rather too much growth.

Ordinarily, the crop takes from four to four and a-half months to mature. As the whole of the bolls do not ripen at once, it is necessary to allow the main crop to fully ripen and develop and the bolls to open well before attempting to pick. A second and possibly a third picking may be necessary to ensure the harvesting of the full crop.

Harvesting.—Picking should not commence until the dew has completely dried off the cotton. Cotton picked in the morning should be exposed to full sunlight for some hours before baling, to thoroughly dry it out.

The strictest care should be exercised to keep the seed cotton free from leaves, sticks, dirt, or foreign matter of any description, and stained or discoloured cotton, unripe and dead locks, should not be mixed with the clean, sound, marketable sample.

Clean bales should preferably be used for the reception of the crop. These require to be legibly branded before despatch to their destination—the Australian Cotton Growing Association's Ginnery, either at Whinstanes, near Brisbane, or Rockhampton, whichever is the nearer.

AMERICAN TYPE OF COTTON PICKING BAG.

The cotton picking bag illustrated is in general use in American cotton fields, and it is recommended by the Australian Cotton Growing Association. The bag is 6 feet deep with one side extended to form an apron to rest against the user's body and to provide a rubbing surface when pushing the cotton down into the mouth of the bag.

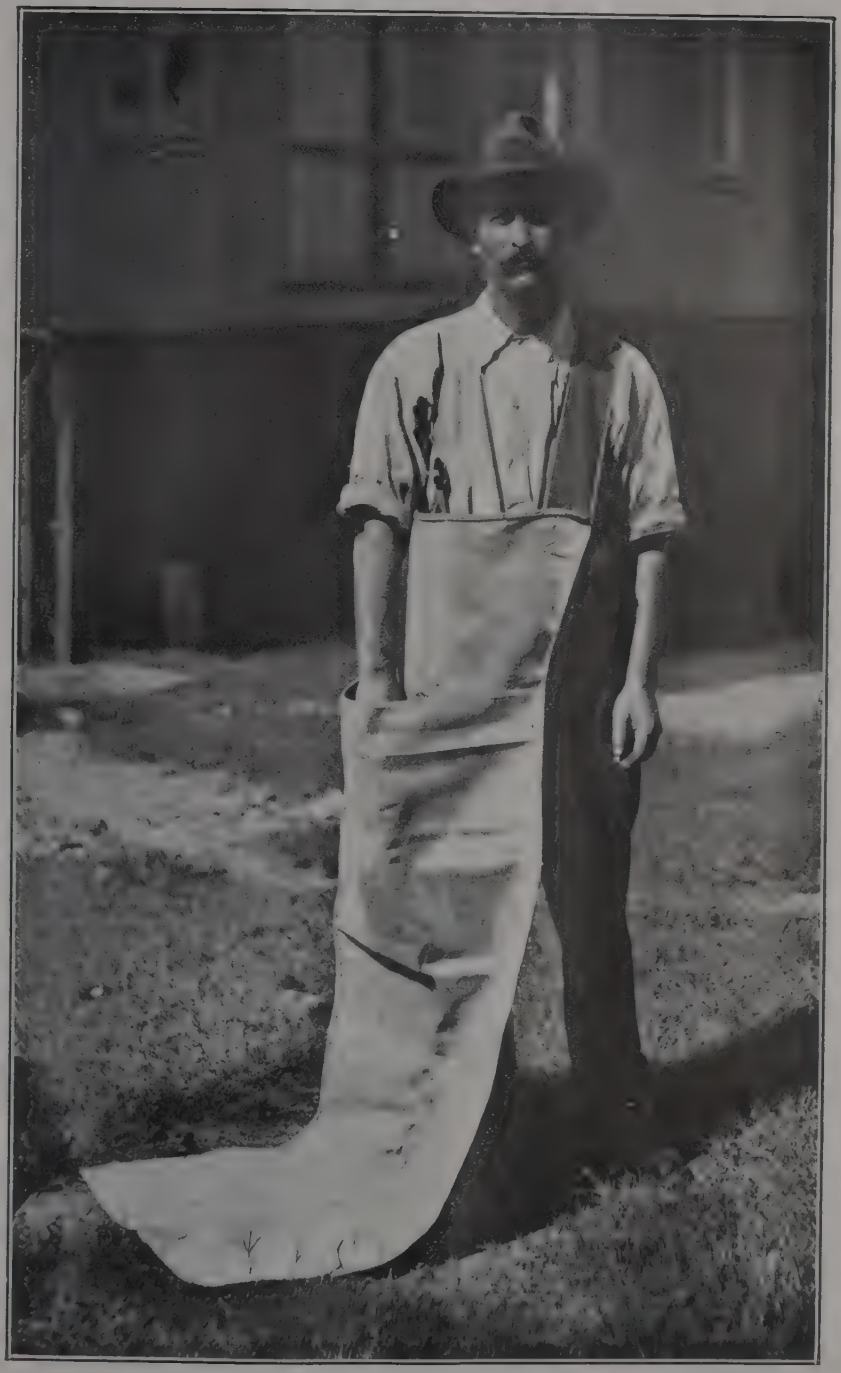


PLATE 64.—A COTTON-PICKING BAG.

UPPER BROOKFIELD.

By J. MITCHELL, Instructor in Fruit Culture.

How few Brisbane people there are who know of the existence almost at their doors of Upper Brookfield; its wealth of natural beauty and its material wealth hidden, and, seemingly, as yet unbidden, in its practically untilled soil. Within a few miles of the Brisbane G.P.O. is a stretch of country that is a delight to the eye of the Nature lover, a happy hunting-ground of the naturalist, a glory of virgin woodland, a land of golden promise slowly emerging from the primitive to the practical. Fertile valleys checked in green and brown with growing crops and furrowed fields, silver-threaded with crystal streams, and sheltered by ranges ribbed with densely forested buttresses—all this is Upper Brookfield. It would seem that Nature herself planned this beautiful locality for one great garden, and, though within the traffic roar of a great metropolis, to-day only the staccato tap of a settler's axe or the call of a bird to its mate awakens echoes down along its scrub shaded silences.

Soil Fertility.—The land in the Upper Brookfield area is very fertile, and with proper cultivation it would grow many varieties of fruit. The country already cleared for dairying is rather too open for successful banana culture, but large areas of standing scrub sheltered by the range and of suitable soil and aspect should provide successful plantations.

Cultivation and Settlement.—Among the newer settlers are several returned soldiers, who have already made great headway on their holdings. Among these are Messrs. F. Midgely, Jos. Soper, and A. D. Gillies. Right at the head of a creek in a crescent-shaped pocket is the plantation; admirably situated and sheltered is the plantation of the last-named, and one of the snuggest and best-worked little properties in the district. Mr. Gillies is a believer in intense cultivation, and he keeps his banana plants on the single-corm system. In no case are more than two followers allowed at the right time—that is, when the parent plant is allowed to throw its bunch. The area has been planted 12 ft. by 12 ft. Where the land is so fertile, with a sufficiency of humus, it might be advantageous to plant one sucker between each two plants in one row, thus making the plantation 12 ft. between the rows and 6 ft. in the row. The 6-ft. rows should be across the hillside, where washaways are likely to occur. All decaying stalks and leaves might be supplied as manure to this row. In selecting suckers as followers, it would be wise to leave the young plant on the upper or hillside. To keep the plants their proper depth in the soil, when suckering or pruning, the bulb should be disconnected from the parent plant. Planters in this locality would be well advised to cut out the maiden plants in the course of July or August that are likely to produce what are called November bunches. This practice will foster good suckers giving a bunch ready for the winter cut.

Accessibility.—With a personal equation among its settlers of high value, backed by fertility and climate, Upper Brookfield is bound to come into its own, but its immediate progress is retarded by its primitive roads. The settlers declare that all they require is a main road to be constructed by the Main Roads Board. The settlement would thus be brought within an hour of metropolitan markets by motor lorry. With such a fertile and productive area at the door of the city, apart from the tourist value of such a road, it should not be long before their very reasonable hope is realised.

AUSTRALIAN MEAT FOR BRITISH ARMY AND NAVY.

In England recently Mr. Jowett, M.P., expressed surprise that the Imperial Government contracts for the supply of navy and army with Argentine frozen beef were still in existence. He point out also that an arrangement existed for certain Argentine meatworks to be run on the Board of Trade account, thus shutting out Australian beef from army and navy contracts. Mr. Jowett directed attention to this injustice to Australian producers, and was informed that the British army contracts now running will cease after 30th June. After that date the army will be prepared to take Australian meat. In this connection Queensland houses have been asked by the importers of Queensland beef in London to reduce freezing charges by one-eighth of a penny a pound, this reduction to be made unconditionally, and to facilitate the reduction of freight charges and other Australian costs.

PLATE 65.—BANANAS GROWN BY A SOLDIER SELECTOR, BROOKFIELD, NEAR BRISBANE.

PLATE 66.—A SOLDIER SELECTOR'S HOMESTEAD ON BANANA PLANTATION, BROOKFIELD.

PLATE 67.—BANANA-GROWING ON MR. GILLIES' SELECTION, BROOKFIELD.

PLATE 68.—BANANA PLANTATION ON MR. GILLIES' SELECTION, BROOKFIELD.

PLATE 69.—BANANAS ON A SOLDIER'S SELECTION, BROOKFIELD.

PLATE 70.—YOUNG PLANTATION ON A SOLDIER'S SELECTION, BROOKFIELD.

TREATMENT FOR STOMACH WORMS IN SHEEP.

Mr. J. Legg, B.V.Sc., M.R.C.V.S., Government Veterinary Surgeon, Townsville, writes:—

"I am in receipt of a report concerning treatment of stomach worm in sheep, which was kindly forwarded to me from South Africa by the Director of Veterinary Research, and, among other things, it contains some valuable information concerning the treatment of stomach worms in the sheep.

"Comparisons were made between various drugs and combinations of drugs, regarding their efficacy in removing the stomach worm from sheep or heavily infested animals, and it was found that a combination of copper sulphate and sodium arsenite was not only superior to any other drug, but was superior to any other of the arsenic compounds.

"This combination was found in most instances to remove 100 per cent. of stomach worms, even in those cases where gross infestation had been invoked by artificial means.

"The drugs are used in the powder form, and each dose is placed on the back of the tongue by means of an ordinary teaspoon. The operator simply opens the mouth of the sheep and places the dose on the back of the tongue with the spoon. A large number of doses can, of course, be made up in bulk, and a series of small spoons are used in administration, each spoon when full to the rim holding the required dose. One man carries the mixture in a bowl, and with the spoon picks up the required dose and places it in the teaspoon held by the operator who doses the sheep. In this way it is found that a large number of sheep are quickly dosed.

"Doses are as follows:—

Age of Lamb.	Sodium Arsenite.	Bluestone.
2 to 4 months	½ gr. = 36 m g = ·555552 gr.	2¼ gr. = 144 m.g. = 2·222208 gr.
4 to 6 months	¾ gr. = 50 m.g. = ·7716 gr.	3 gr. = 200 m.g. = 3·0864 gr.
6 to 10 months	1⅛ gr. = 75 m.g. = 1·1574 gr.	4¾ gr. = 300 m.g. = 4·6296 gr.
2 tooth ..	1½ gr. = 100 m.g. = 1·05432 gr.	6 gr. = 400 m.g. = 6·1728 gr.
4 tooth ..	2 gr. = 125 m.g. = 1·929 gr.	7¾ gr. = 500 m.g. = 7·716 gr.

M.g. means milligrams."

AN EXTENSIVE FARMER.

Accompanying the Empire Exhibition delegation is Mr. F. Hiam, a member of the National Institute of Agricultural Botany (U.K.), and probably the most extensive farmer in England. He has about 7,000 acres under cultivation in Norfolk and Suffolk, with his headquarters at Cambridge, from which there is a system of telephonic communication with the various portions of his estates. His remarks in the course of a Press interview will interest Queensland farmers, throwing as they do a sharp light on methods of farm management in the United Kingdom, the efficiency of which so impressed members of the A.I.F. who took advantage of the opportunities provided for them under the A.I.F. educational scheme to study at first hand farming practice in the old country. Speaking of his work Mr. Hiam said:—

"An early start is necessary, as sometimes orders arrive, say, for the immediate delivery of 100 tons of potatoes. My farms are in two blocks, which are 10 miles apart, and these are served by a light line of railway. Each block comprises a group of farms containing 300 acres, and each farm is in charge of a bailiff, and there is again a chief bailiff in control of every 3,000 acres, and a head bailiff supervises the whole staff. I go in extensively for the cultivation of potatoes. My annual crop is generally about 2,300 tons, and I sometimes plant the same land for two or three years in succession with tubers, and then sow the land with wheat. There is no need to plough the ground for the wheat crop, and the seed is merely harrowed in. The potato land is ploughed from 10 in. to 1 ft. deep, three horses being used for every single-furrow plough. I tried tractors, and scrapped them, as I consider horses a much cheaper proposition. Altogether I have used ten different kinds of tractors, which cost on an average £750 apiece, and after working for four years I could not get £50 each for them. I fallow the wheat crop again to a great extent with potatoes, and the seed comes from Scotland, where I produce 2,000 tons of seed potatoes annually. These potatoes are produced profitably at 30s. a ton, and are the best in the world for seed purposes, a very large quantity being exported every year to America.

A SUMMARY OF EXPERIMENTS CARRIED OUT BY THE BUREAU OF SUGAR EXPERIMENT STATIONS, FROM 1902.—II.

By H. T. EASTERBY, General Superintendent.

The first article of this series, in the course of which Mr. Easterby discussed deep cultivation experiments and tabulated comparative crop results from subsoiled and non-subsoiled fields, was published in the May Journal. The second instalment is an account of the results of irrigation experiments and the action of irrigation and manures upon the density and purity of sugar juices.—ED.

EXPERIMENTS WITH IRRIGATION.

The principal experiments with irrigation for cane crops were carried out at the Mackay Sugar Experiment Station from 1905 to 1909. The question was approached from two sides. On the one hand tests were made in order to show what deep, thorough, and subsoil cultivation will do in the matter of aiding the crop or crops to resist the action of drought, and in avoiding the cost of resort to irrigation. On the other hand irrigation was practised to demonstrate its actual net value over a reliance upon rainfall. The results of the irrigation and cultivation experiments go to show that while irrigation will be found to have a high economic value where the water can be obtained and applied at low cost, yet deep, subsoil cultivation, advisable in all conditions with or without irrigation, will enable crops to be grown economically in locations where irrigation is not practicable and where the annual rainfall is fairly good. In the application of water to the cane crop there are two chief modes of distribution. The one, which may be called the Hawaiian method, consists in applying the water to the cane in deep furrows, the furrows being intersected or cut up into short lengths of 20, 30, or 40 ft. By the other method the water is applied in channels between the cane rows, and runs whatever distance is determined upon, which is often from one end of the field to the other. By the latter method there is no such thing possible as an even distribution over all the land, and it is possible to cause great damage to areas where the water can accumulate and stagnate, or where it leaches too freely through into the subsoil, carrying soluble soil elements with it. The application of water to the cane in deep, short furrows is the method securing the maximum value of the water at the highest cost of labour. Irrigation in channels between the rows of cane involves the greatest expenditure and waste of water, with a minimum cost of labour in application, and at the greatest risk of damage to the soil. Both these methods of applying water are largely controlled by the nature of the soil and its subsoil.

The water used for irrigation at the Mackay Station was obtained from an underground running supply, which is believed to underlie large areas of the Mackay delta. By putting down a bore to a depth of 64 ft. below the surface of the station field, and to 20 ft. below the sea level, an abundant supply of sweet water was found. Water was found at 18 ft., at 40 ft., and at 64 ft., whence it was finally obtained, the pressure raising the supply 36 ft. up the pipe. There are, doubtless, other water-bearing strata at lower depths. The water was pumped up into raised tanks. Every gallon of water used in the experimental irrigation tests was measured and applied direct from the tanks.

The irrigation experiments mentioned above were carried out under the following four sets of conditions:—

1. Irrigation, mixed manures; all other conditions of cultivation being equal.
2. Irrigation, no manures; all other conditions of cultivation being equal.
3. No irrigation, mixed manures; all other conditions of cultivation being equal.
4. No irrigation, no manures; all other conditions of cultivation being equal.

These experiments were planted in April, 1905, upon uniform land, and in a soil of uniform depth and composition.

The cultivation was the same upon all the plots within the series, and comprised the following acts:—The ground was ploughed to an actual depth of 12 in.; after the plough the subsoiler went to a further depth of 8 in., thus furnishing a depth of loose soil of not less than 20 in. Three cross-ploughings followed at intervals of not more than four weeks. The final result of all the preparatory cultivation was that the soil was in the condition of a fine loose tilth to the depth already stated.

The cane on all these comparative test plots was planted as follows:—Sets with three eyes were planted 6 in. apart in the row, and covered with a depth of 3 in. of soil. The rows in all these experiments were exactly measured and were 5 ft. apart.

The planting was immediately followed by heavy rains lasting over a month, and then by very cold dry weather, which checked the germination and growth of the cane.

The remaining six months of 1905 were the driest recorded for some years, only 7 in. of rain falling in the whole of that time. This dry spell enabled the irrigated plots to take and maintain the lead, and the tables of results, in a later place, will indicate that the initial effect of these climatic conditions have had a controlling influence on the final crop results, particularly in the case of the non-irrigated plots.

RESULTS OF THE PLANT CROP, 1906.

The action of irrigated water and manures upon the chemical composition of the juice is shown in the following table:—

Conditions.	Average Density of Juice (Brix.)	Average Sucrose in Juice.	Average Quotient of Purity.
Irrigated plots: Mixed manures ..	19·15	17·409	90·90
Irrigated plots: No manures	19·43	17·837	91·80
Non-irrigated plots: Mixed manures ..	18·86	17·295	91·70
Non-irrigated plots: No manures ..	19·49	18·219	93·47

With reference to this table it is indicated—First, that irrigation, which means a maximum or some excess of moisture, has tended to lower the purity of the juice; second, it is also indicated, both upon the irrigated and non-irrigated plots, that the manures while increasing the production of cane tend to a slight depreciation in the purity of the juice. This result is in agreement with the results at other experiment stations. These results, however, are not without exceptions, for, upon land which has become thoroughly exhausted by long and continuous cropping, the application of a mixed manure very frequently results in an improvement of the quality of the juice as well as in the yield of cane per acre.

A summary table is now furnished which presents the results from the plant crop obtained under the four sets of conditions, already explained, in a ready form for general oversight. These summary results show that, upon the irrigated plots, the manures resulted in an additional yield of 4½ tons of cane, and of half a ton of sugar, to the acre. Upon the non-irrigated plots, while the manures gave an additional yield of 3½ tons of cane to the acre, the increase in the sugar per acre was very small.

SUMMARY TABLE.

Conditions.	Weight of cane per Acre in English tons.	Yield of Sugar pe Acre in English tons.
Irrigated plots: Mixed manures, other conditions of cultivation being equal	58·4	9·1
Irrigated plots: No manures, other conditions of cultivation being equal	54·1	8·6
Non-irrigated plots: Mixed manures, other conditions of cultivation being equal	50·7	7·7
Non-irrigated plots: No manures, other conditions of cultivation being equal	47·4	7·6

In considering the action of the manures it has to be repeated that all of the plots now under consideration not only were subjected to deep ploughing, subsoiling, and a very thorough preparation by repeated cross-ploughings, but the whole of the land received the application of something over 2 tons of burnt lime per acre. This deep and thorough cultivation, with the lime, would cause a large proportion of the chemical plant food elements to be brought into a soluble and available condition for the use of the crop. These effects would therefore proportionately tend to lessen the special action of the manures, and to reduce the difference in the results between the manured and unmanured plots. As a matter of fact, large results were not expected in the plant crop from the manures; but it was expected that the same manures would give a larger account of themselves upon the several succeeding ratoon crops.

RESULTS FROM FIRST RATOON CROP OF ABOVE EXPERIMENTS, 1907.

The action of irrigation and manures upon the density and purity of the sugar juices is set out in the table following, where it is seen that the indications pointed out in the plant crop have been again repeated—namely, that irrigation and manures have a tendency, while increasing the yield, to lower the purity of the juices.

THE ACTION OF IRRIGATION AND MANURES UPON THE DENSITY AND PURITY OF SUGAR JUICES.

Conditions.	Average Density of Juice (Brix.)	Average Sucrose in Juice.	Average Quotient of Purity.
Irrigated plots: Mixed manures ..	20·0	18·18	90·9
Irrigated plots: No manures	20·5	19·06	92·9
Non-irrigated plots: Mixed manures ..	19·5	17·63	90·4
Non-irrigated plots: No manures ..	20·6	19·53	94·8

The summary table following presents the average results obtained from the plots under the four sets of conditions. It is shown that the irrigated plots with manures gave a slightly lower result than the corresponding non-irrigated plots with manures; while the irrigated plots with no manures gave a slightly higher result than the corresponding non-irrigated plots with no manures. The irrigated plots with manures show an increase of 9.3 tons of cane per acre and 1.3 tons of sugar over the irrigated plots with no manures; and the non-irrigated plots with manures show an increase of 10.7 tons of cane and 1.2 tons of sugar per acre over the non-irrigated plots with no manures.

SUMMARY TABLE.

Average of Results from the First Ratoons under the Four Sets of Conditions set forth.

Conditions.	Weight of Cane per Acre in English tons.	Yield of Sugar per Acre in English tons.
Irrigated plots: Mixed manures, other conditions of cultivation being equal	41·9	6·8
Irrigated plots: No manures, other conditions of cultivation being equal	32·6	5·4
Non-irrigated plots: Mixed manures, other conditions of cultivation being equal	42·4	6·7
Non-irrigated plots: No manures, other conditions of cultivation being equal	31·7	5·4

In comparing the results from the first ratoon crop with those obtained from the plant crop last year, it must be remembered we are now dealing with a ten and a-half months' crop, the plant crop being seventeen months old at time of harvest.

RESULTS FROM SECOND RATOON CROP, 1908.

SUMMARY TABLE.

Average of Results from the Second Ratoons under the Four Sets of Conditions.

Conditions.	Weight of Cane per Acre in English tons.	Yield of sugar pe Acre in English tons.
Irrigated plots: Mixed manures, other conditions of cultivation being equal	39·5	6·3
Irrigated plots: No manures, other conditions of cultivation being equal	24·0	3·9
Non-irrigated plots: Mixed manures, other conditions of cultivation being equal	38·8	6·1
Non-irrigated plots: No manures, other conditions of cultivation being equal	24·1	4·0

PLATE 71.—INTERIOR OF LABORATORY, SUGAR EXPERIMENT STATION, MACKAY.

The irrigated plots with manures in the second ratoon crop have given a slightly higher yield over the non-irrigated plots with manures, the difference being equivalent to 14 cwt. more cane per acre. On the other hand, the irrigated plots without manures give a very slightly lower result when compared with the non-irrigated plots without manures, the difference in favour of the latter being 2 cwt. more cane per acre. The irrigated plots with manures show an increase of 15½ tons of cane per acre and 2.4 tons of sugar per acre over the irrigated plots with no manures, while the non-irrigated plots with manures, show an increase of 14.7 tons of cane per acre and 2.1 tons of sugar per acre over the non-irrigated plots without manures.

RESULTS FROM THIRD RATOON CROP, 1909.

SUMMARY TABLE.

Average of Results from the Third Ratoons under the Four Sets of Conditions.

Conditions.	Weight of cane per Acre in English tons.	Yield of Sugar per Acre in English tons.
Irrigated plots: Mixed manures, other conditions of cultivation being equal	35·13	5·86
Irrigated plots: No manures, other conditions of cultivation being equal	19·63	3·32
Non-irrigated plots: Mixed manures, other conditions of cultivation being equal	35·95	5·91
Non-irrigated plots: No manures, other conditions of cultivation being equal	19·86	3·26

In these and other experiments with irrigation it was conclusively proved that in normal years at Mackay, with a fair rainfall, good deep cultivation will give as good results as are to be obtained with irrigation. Of course, it need not be said that in dry years irrigation greatly increases the crop, but as many Northern sugar districts only get one or two dry years out of ten it is very questionable whether the installation of an irrigation plant would pay outside of the Lower Burdekin and some of the Southern districts. The finest results from irrigation are always obtained in places where the average rainfall is low.

The methods of cultivation of the ratoons upon the non-irrigated plots were as under:—

> The middles were split open with the swing plough, followed by the subsoiler to a depth of 18 in. Those furrows next the cane were then ploughed away from the rows and similarly subsoiled, thus ensuring all ground between the rows being thoroughly moved and subsoiled. The mixed fertilisers were then applied to those plots which were to be fertilised, in the furrow next to the cane, which were then closed by the plough, this act also taking place with the plough on the non-manured plots, so as to secure unformity of cultivation. The Planet Junior cultivator, fitted with broad hoes, was then run over all the ground between the stoles to level same down, and this implement was used for subsequent shallow cultivations while the cane was young.

On the irrigated plots no cultivation with implements took place, but the stole bed was loosened with picks, and the land subsequently kept clean with hand-hoeing while cane was young. Mixed fertilisers were applied to those plots carrying manures.

SUGAR: FIELD REPORTS.

The Southern Field Assistant, Mr. J. C. Murray, reports, 4th May, 1922, as follows:—

In the course of April the districts of Mount Bauple and Bundaberg were inspected.

Mount Bauple.—There is a good showing of cane at Bauple. The crops, however, are just feeling the effects of the dry weather, but as they are generally well forward there is no need to anticipate serious deterioration unless the dry weather persists.

Cane varieties making a good showing are 1900 Seedling, D.1135, Q.1098, Shahjahanpur No. 10, E.K.1, Q.822, Q.813, and H.Q.426 (Clark's Seedling). The three most prominent varieties of these are probably M.1900 Seedling, D.1135, and Q.822. The former is especially doing well and should justify its cultivation on Bauple with more extensive planting.

Tillage of soil is uniformly good, although the texture in places could be improved by green crops. Practically the only cane to show any sign of disease is D.1135. Primary symptoms of striped leaf disease are appearing in patches of cane, and here and there the secondary stage of this disease is in evidence by the cracked and cankered appearance of the stem and the general weakening of the internode. Various kinds of fungi enter these cracks in the stem and destroy the soft tissue, with the result that on windy days the cane breaks off and falls to the ground. Growers should observe this variety carefully, especially in selecting plants.

The best method of plant selection is to survey the cane as it stands, before cutting the plant. Observe the leaf first and make sure the colour is a healthy green and free from rust or stripes. Then let the eye travel down the stem of the cane and observe whether the growth of adventitious roots is excessive, whether the trash is adhesive, and the occurrence of cracks and signs of deterioration in the stem. An experienced observer can, if he bears the foregoing in mind, at a glance form a very fair idea of the quality of the cane he is going to plant.

Fertilising at Mount Bauple is being carried out on a more liberal scale than hitherto. A mixture giving good results to M.1900 Seedling is 200 lb. sulphate of ammonia, 350 lb. superphosphate, and 70 lb. sulphate of potash per acre.

Mount Bauple farmers are taking the keenest interest in sugar-cane culture at the present time, and consider nothing too much trouble if it will benefit their district and assist in reaching that point when the land is producing the maximum. This can be done, however, only by continually improving the texture of the soil, by methodical crop rotation, by careful fertilising, and careful selection of plants and varieties. The district is a good one, but it is as yet producing far below its capacity.

Bundaberg.—Rain is just now wanted in the Bundaberg district. While most of the cane still is considerably resistant to drought, there will be a severe check if rains do not come during May. The Demerara 1135 appears to be suffering most, especially on the higher lands; the broader leafed canes are sheltering the soil better and preventing rapid evaporation. Conditions are not quite so dry on the alluvial loams as on the volcanics, although the degree of fertility is about equal, owing to the better texture of the red soils.

Growers are not being caused much loss at present by parasitic agencies or fungi, although the latter is here and there in evidence on the leaf of D.1135.

Good results are being obtained from meatworks manure on the red soils, while, generally speaking, these are giving negative results on the black loams. Cowpeas and stable refuse are the best manures for the heavier soils, owing to the necessity for improved texture. Excellent results are being obtained on the volcanic soils by rotating maize crops. Bare fallowing should not be done on the porous red loams. Leguminous crops should be grown and ploughed under as a soil-restoring measure.

A 25 per cent. basis would be a good method of working most Woongarra farms at present. That is 25 per cent. plant crop, and the same area of ratoons, standover, and land under renewal process. That would mean that once in four years the whole farm should have been green-cropped with either maize, cowpea, or whatever the grower considered gave the best results.

Varieties doing well at present are E.K.1, E.K.28, Q.813, H.Q.426, 1900 Seedling, Q.1095, Shahjahanpur No. 10, M.189, B.147, Q.1112, H.Q.77, and H.Q.285. The Shahjahanpur is showing considerable resistance to frost. The Shahjahanpur is developing into a good cane, the stick becoming thicker and the trash less adhesive.

Most of the other varieties are fairly well known now to the farmer. The E.K.1 is showing particularly well.

There is a considerable development of canegrowing at Elliot Heads. The soil is a light forest loam, which cultivates and drains satisfactorily. The farmers are doing well and extending and improving their holdings.

This country is well watered and free from frost. The farmers would do well to pay attention to the question of green-cropping.

ORGANISATION OF THE AGRICULTURAL INDUSTRY

The Queensland Producers' Association: How it will be Constituted.

Laying the Foundations for State-wide Rural Co-operation.

Steps have been taken to provide a completely unified national organisation for the Agricultural Industry, in accordance with the scheme of the Premier (Hon. E. G. Theodore), and those steps have led up to the establishment of an Association to be called "The Queensland Producers' Association." This Association is to be open to every producer in Queensland, and will embrace dairymen, fruitgrowers, wheatgrowers, small graziers, sugar producers, and general farmers.

THE QUEENSLAND PRODUCERS' ASSOCIATION.

The Association will consist of a Council of Agriculture, District Councils, and Local Producers' Associations. The Provisional Council already has been constituted, and consists of representatives of the dairying, fruitgrowing, wheatgrowing, sugar-producing, and general farming industries. The representatives of the dairying industry were nominated at a special conference representing all dairying interests, which was held in Brisbane on 24th March, 1922; the representatives of the fruit-growing industry at the annual meeting of the Southern Queensland Fruitgrowers' Society; the representatives of the sugar industry by the executives of the United Canegrowers' Association and Australian Sugar Producers' Association, and the representatives of the wheatgrowing and general agricultural interests by the State Wheat Board, which is itself a growers' organisation. The Minister for Agriculture (the Hon. W. N. Gillies) is the President of the Council. The objects of the Council are to co-operate with the District Councils, the Local Producers' Associations, the Department of Agriculture and Stock, and other bodies in such matters as:—

(i.) The development of the rural industries;

(ii.) Investigating and dealing with problems relating to the rural industries;

(iii.) Advising agriculturists with regard to matters which require scientific knowledge and training;

(iv.) Research on subjects pertaining to the rural industries;

(v.) Securing effective action for the controlling of diseases and pests generally;

(vi.) The securing of additional markets for the disposal of produce and of improved means of distribution;

(vii.) The securing of improved means of transport;

(viii.) The watching of markets and the commercial side of the rural industries generally;

(ix.) The general policy of standardising;

(x.) Extending the usefulness of the professional staff of the Department of Agriculture;

(xi.) Matters in relation to agriculture and production which may be referred to the Council by the Minister;

(xii.) Generally advising, assisting, and co-operating with the Department of Agriculture in all matters pertaining to the rural industries.

The Council has framed its constitution, and has from amongst its members appointed Standing Committees. These Standing Committees are —

COMMITTEE.	PERSONNEL.
Administrative ..	Messrs. S. G. Howe, F. J. Morgan, G. H. Pritchard, J. Purcell, H. C. Quodling, W. J. Short, and J. D. Story.
Transport .	Messrs. J. W. Davidson, A. Douglas, A. J. Muir, and W. Ranger.
Dairying	Messrs. A. Douglas, H. McAnally, J. Purcell, W. J. Sloan, and J. T. Tod.
Fruit	Messrs. T. H. Brown, S. G. Howe, W. Ranger, H. I. Ross, and F. M. Ruskin.
Sugar	Messrs. W. G. Batchelor, C. V. Hives, T. A. Powell, G. H. Pritchard, and W. J. Short.
Wheat	Messrs. H. McAnally, F. J. Morgan, A. J. Muir, H. C. Quodling, and R. Swan.

In order that a Standing Committee may get the best technical and expert advisers available, it has been approved that any Standing Committee may associate with it any officer of the Department of Agriculture or other person as the Council may from time to time determine. Persons associated with Standing Committees will act in a consultative capacity but will not have a vote. The duties of the several committees have been allocated as follows:—

(*a*) *Administrative.*—To deal with or advise in regard to matters relating to administration, organisation, staff, finance, and generally such matters as are not specifically assigned to other Standing Committees.

(*b*) *Transport.*—To deal with or advise in regard to all matters relating to transport, whether by road, rail, steamer, or otherwise.

(*c*) *Dairying.*—To deal with or advise in regard to all matters relating to the dairying industry.

(*d*) *Fruit.*—To deal with or advise in regard to all matters relating to fruit and vegetable industry.

(*e*) *Sugar.*—To deal with or advise in regard to all matters relating to the sugar industry.

(*f*) *Wheat.*—To deal with or advise in regard to all matters relating to the wheat industry, and also to such products as maize, cotton, rice, tobacco, &c.

The Council has referred the following matters for consideration as soon as possible by the respective Standing Committees, namely—

(A) Dairying –

1. *Production*—

(i.) To devise means of co-operation with the Lands Department regarding the opening-up of suitable lands for dairying purposes;

(ii.) To advise as to the best fodders to grow, and the best means of fodder and water conservation; need for revival of fodder-conservation campaign in good seasons, and consideration of "silo pool" system;

(iii.) To advise as to best pure-bred or grade stock available for purchase, &c., and general animal husbandry;
assistance in —

(iv.) To consider the best means of improvement in quality of herds by
1. Herd testing;
2. Purchase of stud stock;
3. Co-operation with private breeders and Herd Book societies.

(v.) To advise as to the best means of erecting standard dairy buildings, and of the purchase of dairy machinery and utensils.

2. *Manufacture*—

To advise in relation to—

(i.) The essentials of production of first-quality milk and cream;

(ii.) The organisation of suitable transport to factories;

(iii.) The essentials to be obesrved universally at factories to ensure uniformity of grade, including instruction to the suppliers of low-grade produce;

(iv.) The initiation of a uniform system of factory accounts and general factory management, with a view to reducing the cost of production;

(v.) The most economical method of procuring butter-boxes and other factory requisites.

3. *Marketing*—

To advise in relation to—

(i.) The best methods of packing and presentation for market;

(ii.) Co-ordination with Federal authorities in regard to grading and securing adequate information as regards defects noted by graders with a view to improvement of quality;

(iii.) The need for standardisation of brands to establish reputation for Queensland produce in interstate and oversea markets.

4. *Storage*—

To advise in relation to the best form of control of State cold stores.

5. *Distribution*—

LOCAL—

To advise in relation to—

(i.) The question of controlling local distribution, to ensure that dairy produce is retailed at reasonable rates according to actual quality, and that inferior produce is not offered for sale;

(ii.) The question of establishing pools or central distributing agencies.

INTERSTATE AND OVERSEAS—

To advise in relation to—

(i.) The question of adequate shipping facilities and the establishment of central co-operative distributing agencies in Southern capitals and overseas;

(ii.) The necessity for appointment at the Agent-General's office of a dairy produce expert of business ability to report on the arrival of Queensland consignments in London and keep in touch with marketing thereof.

It has also been mutually arranged that the Dairying Standing Committee of the Provisional Council of Agriculture and the Dairying Industry Advisory Board shall act conjointly in dealing with all matters relating to the dairying industry which have been referred to these bodies.

(B) Fruit—

To consider—

1. In conjunction with the Department of Agriculture and Stock, the problems relating to the fruit industry of this State;
2. The question of improvement of the productiveness of orchards by systematic instruction in fruit culture in all its branches, by scientific investigation to prevent loss through diseases and pests, or by other efficacious means;
3. The efficacy of the existing Diseases in Plants Act, and to suggest any amendment that may be considered necessary with a view to the more efficient control of diseases and pests generally by compulsory cleanliness of orchards and prompt destruction of infested fruit;
4. The question of standardisation generally, including fixation of marketing standards of various fruits, institution of co-operative local or central grading and packing establishments, and the necessity for additional legislative authority to provide for the above;
5. The question of improved methods of storage and transport, including experiments in and adequate provision of suitable storage for fresh fruits; to assist in the regulation and transport of supplies for local interstate and oversea markets;
6. Marketing and distributing problems;
7. The establishment of pools or co-operative local interstate and oversea selling agencies;
8. The efficacy or otherwise of the Farm Produce Agents Act as a protection to growers consigning fruit to local markets;
9. The institution of a campaign for the popularising of the use of fruit, and for the creation of a stronger demand for Queensland fruits throughout Queensland and the other States of the Commonwealth.
10. The question of utilisation of surplus supplies by the establishment of co-operative canning and preserving plants, and the standardisation, labelling, and marketing of such products.
11. The question of extending the benefits of the Co-operative Act, or any other means of establishing credit for the encouragement of co-operation in the industry.
12. The best means of securing the effective co-operation of existing associations and Government institutions, including the State cold stores, State canning works, State Produce Agency, State Advances Corporation, and the Railway Department.

(C) Sugar-

To consider—

1. The question of the improvement of the productiveness of sugar lands by the planting of the best varieties, by the use of fertiliser, &c.
2. The question of means of combating diseases and pests.
3. The question of the purchase of fertilisers and farm implements through co-operative channels.
4. The question of assurance against losses through cyclones, fire, grubs, &c.
5. The devising of ways for the economic use of present waste products.
6. The question of a credit system with a view to assisting new settlers or to assisting canegrowers affected by failure of crops in dry seasons or otherwise.

(D) Wheat and General Agriculture—

To consider—

1. The question of investigating, in conjunction with the Department of Agriculture and Stock, the problems relating to the wheat and general agricultural industries of the State.
2. The methods of production, marketing, storage, and distribution of wheat, and of general agricultural produce.
3. The question of the continuance of the policy of wheat pools and of the possibility of the extension of the policy of pools to other branches of the general agricultural industry.
4. The question of the purchase of all farm requisites through co-operative channels.
5. The question of wheatbreeding, and the question of pure seeds as applying to the industry generally.
6. The question of extending the benefits of the Co-operative Agricultural Production and Advances to Farmers Act, or any other means for the establishment of rural credit.
7. Consideration of any matters arising in connection with general agriculture throughout the State; including the question of the appointment of expert instructors in the cultivation of cotton, rice, tobacco, or other crops.

Subjects referred to the Dairy Advisory Board—

To consider—

(*a*) The question of investigating, in conjunction with the Department of Agriculture and Stock, the problems relating to the dairying industry of this State;

(*b*) The methods of production, manufacture, marketing, storage, and distribution of dairy produce;

(*c*) The question of the establishment of pools for dairy produce;

(*d*) The question of the co-ordination of the activities of existing co-operative companies;

(*e*) The question of the improvement of the productiveness of the individual dairy herds by general application of systematic herd-testing or any other efficacious means;

(*f*) The question of the purchase of all factory and farm requisites through co-operative channels;

(*g*) The question of fodder conservation;

(*h*) The question of extending the benefits of the Co-operative Agricultural Production and Advances to Farmers Act, or any other means for the establishment of rural credit.

DISTRICT COUNCILS.

In each district determined by the Council of Agriculture there is to be established a District Council. Pending the establishment of permanent District Councils, provisional district councils may be constituted upon the recommendation of the Council of Agriculture. These provisional councils will hold office for a period not

exceeding one year in the first instance. Each of the approved districts will determine the number of members who will constitute the District Councils. In the beginning there are to be fifteen districts, namely—

No. of District.	State Electorates included in the District.
1	The new State Electoral Districts of Cairns, Chillagoe, Cook, Eacham, Herbert.
2	The new State Electoral Districts of Bowen, Kennedy, Mundingburra, Townsville.
3	The new State Electoral Districts of Charters Towers, Queenton.
4	The new State Electoral Districts of Mackay, Mirani.
5	The new State Electoral Districts of Fitzroy, Mount Morgan, Normanby.
6	The new State Electoral Districts of Keppel, Port Curtis, Rockhampton.
7	The new State Electoral Districts of Bundaberg, Burnett, Musgrave.
8	The new State Electoral Districts of Burrum, Gympie, Maryborough, Nanango.
9	The new State Electoral Districts of Cooroora, Wide Bay.
10	The new State Electoral Districts of Aubigny, Brenner, Cunningham, Ipswich, Lockyer
11	The new State Electoral Districts of Bulimba, Logan, Murrumba, Nundah, Oxley, Stanley (also, *pro forma*, Metropolitan constituencies).
12	The new State Electoral Districts of Albert, Fassifern, Rosewood.
13	The new State Electoral Districts of Drayton, Pittsworth, Toowoomba, and Toowoomba East.
14	The new State Electoral Districts of Carnarvon, Warwick.
15	The new State Electoral Districts of Dalby, Maranoa, Murilla.

Additional districts and District Councils for those additional districts may be constituted from time to time upon the recommendation of the Council of Agriculture. Subject to the general control of the Council of Agriculture, each District Council may make its own rules with regard to the conduct of its business. The duties and functions of the District Councils will include:—

(1) To secure co-operation as far as possible amongst the primary producers in the area covered by the District Council, regarding their common requirements;

(2) To assist in developing schemes, in regard to production, marketing, standardisation, &c.

(3) To assist in suggesting schemes for making more profitable use of the State experts and the facilities generally of the Department of Agriculture:

(4) To assist in such matters as demonstrations of various kinds, co-operation in the purchasing of machinery, fertilisers, &c., promoting of herd-testing, fodder conservation, and to spread amongst the primary producers the latest and best information bearing on agriculture;

(5) Generally, such other duties and functions as the Council of Agriculture may determine.

Local Producers' Association—

As an auxiliary to the District Councils there will be Local Producers' Associations. In any centre in which there are (say) no fewer than (say) ten *bonâ fide* primary producers, a Local Producers' Association may be formed. A convenient centre will be chosen by the District Council concerned to be the headquarters of the District Council. The duties of Local Producers' Associations will include the following—

(1) To take the initiative in rural matters pertaining to the centre represented by the Association;

(2) To ascertain the requirements of the centre and to formulate a scheme for having these requirements met;

(3) To bring before the District Council, through the sub-district representative, requirements and problems which are not of purely local concern but are of common interest and concern;

(4) To support and assist the District Council in its efforts to promote the general prosperity of the primary producers;

(5) Generally, to co-operate with the District Council in enabling it to discharge its functions efficiently;

(6) To endeavour to co-ordinate and correlate the work of the Progress Associations and smaller societies, and to strengthen the work they are doing in so far as it relates to the rural industries.

CANE PEST COMBAT AND CONTROL.

The General Superintendent of the Bureau of Sugar Experiment Stations has received the following report (dated 9th May, 1922) from Mr. Edmund Jarvis, Entomologist at Meringa, near Cairns:—

It is not generally known that we recognise at this laboratory at least fifteen different methods of combating our grey-back beetle during its grub stage.

These have been numerically arranged below according to their relative value as controlling factors, and may be very briefly enumerated as follows:—(1) Soil fumigants; (2) poison baits; (3) hand collecting; (4) soil repellants; (5) cultural methods; (6) larvicidal solutions; (7) introduction of parasitic insectivorous birds and mammals; (10) encouragement of indigenous parasitic and predaceous insects; (11) traps and cover crops; (12) introduction of bacterial diseases; (13) electrical controls; (14) mechanical control; (15) explosives.

It would, of course, be impossible for us to fully investigate *all* of the above-mentioned control methods, any one of the first seven of which could well engage the continuous activities of an entomologist. This fact may be more readily grasped when it is borne in mind that the abovementioned fifteen controlling factors relate exclusively to the grub stage; and that we recognise, and have been investigating so far as time permits, at least eight additional important methods of attacking *Lepidoderma albohirtum* during its aerial condition in the beetle form. Then again, various means of coping with the egg and pupal stages have been studied by us to some extent; with the result that quite recently (August to November, 1921) we have discovered that this cane pest can be destroyed during both of these obscure stages of its life-cycle by means of fumigating the soil with carbon bisulphide.

Naturally we are hoping that experimentation now in progress may yield positive results of an encouraging nature; but, as a rule, such success is preceded by a long series of negative results, which, however, serve a useful purpose by narrowing one's field of observation, thus tending to direct research work into more and more promising channels.

Obviously, the control methods entitled to first consideration in the list given above are those which may be supposed to hold, as it were, the key to the solution of the cane-grub problem.

In the writer's opinion the claims of No. 1 (soil fumigants) stand first and foremost as offering the best chance of successfully dealing with the grub stage of our grey-back cockchafer.

Under the heading of soil fumigants we have such substances as sulphurous anhydride; carbon bisulphide, &c., the latter of which we have used successfully against the grub.

If bisulphide could be administered quickly and evenly by means of suitable machinery it would, I think, be a decided step in the right direction and relieve the present situation very materially; but at the same time we do not, for several reasons, consider that nothing better can be found. During the past two months many fumigants have been tested by us with varying degrees of success. Time and again, as might be expected, the hopes raised by apparently conclusive laboratory experiments have been dispelled, as a result of field application; but, nevertheless, our results taken collectively have been sufficiently encouraging to well warrant closer investigation along similar lines.

Introduction of Parasites.

When reporting on this interesting question in July, 1921, I mentioned that various entomologists had been consulted with the view to obtaining reliable and comprehensive data regarding certain scoliid parasites likely to be serviceable if introduced into our cane fields. During the interval replies to my list of questions have come to hand from Dr. Guy A. K. Marshall, of the British Museum, and Professor S. Leefmans, Government Entomologist, Buitenzorg.

The former entomologist mentions six species of Scoliidae that might meet our requirements. One of these, which resembles our own digger-wasp in colour, but is slightly smaller, inhabits New Caledonia; while three are from Dutch New Guinea, one from the Solomons, and one from Aru Island. He is of opinion that a number of other species hitherto uncollected are likely to occur in the more accessible portions of British New Guinea.

It was very interesting to learn also that the principal insect enemy of our scoliid wasps has not, up to the present, been received by the British Museum from New Guinea; so that very probably wasps introduced from there may be immune from attacks of the hyperparasite that controls the increase of our own digger-wasps.

Professor Leffmans has kindly enumerated nine species of Scoliidae which are parasitic on scarabaeidae in Java. Three of these appear very promising, and might if introduced attack our cane-grubs; one of them, in fact (*Dielis thoracica* Fabr.), being similar in size to our own principal digger-wasp, and parasitic upon grubs of *Lepidiota stigma* F., a cockchafer belonging to the same genus as our cane-beetle *Lepidiota frenchi* Blackb. It also destroys the grubs of *Leucopholi rorida*, a cane bettle which is just the same size as our grey-back beetle.

Dielis thoracica, which is the most promising and abundant digger-wasp, occurs in East Java and on the south coast of Sumatra, where it is found practically throughout the wet season, and also during the dry monsoon of six months. In general it is confined to areas badly grub-infested, attacking second and third-stage grubs of four different scarabaeid beetles. Its life-cycle occupies from thirty-nine to sixty-two days, the intra-cocoon stage being longer than that of our digger-wasp *C. tasmaniensis* Sauss., which has a life-cycle of from forty-three to forty-eight days. Forty-two eggs have been obtained by dissection from one female of thoracica, but in all probability this species, like that of our own digger-wasp, is able to produce about twice that number.

In Java the adult wasps of thoracica frequent honey-bearing flowers belonging to the orders Compositae, Malvacidae, &c., including those of the genus Sida, three species of which occur around Meringa, and are habitually visited by our Campsomeris wasps.

A Bombylid and some Conopid flies are suspected of being hyperparasites of *D. thoracica* and other scoliids in Java; but Professor Leffmans does not consider these of much economic importance.

On the whole the situation with regard to *D. thoracica* appears hopeful, and in the event of its hyperparasites not occurring in Queensland conditions here should be very favourable to the increase of this useful insect. This matter of secondary parasites, however, will be further studied.

At all events we purpose, as a preliminary step, to obtain with as little delay as possible living specimens of thoracica and of *Dielis javana Lep.* (another species likely to prove useful here) for purposes of breeding and study at this laboratory.

Owing to the length of the intra-cocoon stage of both these wasps Professor Leffmans believes that cocoons containing living pupæ could be successfully shipped to Australia. We hope, therefore, to be able to arrange for an exchange of parasites, and have advised him of our willingness to forward to Java cocoons of *Campsomeris tasmaniensis* in return for those of *Dielis thoracica* and *Javana*. This question of the introduction of parasites for our cane-grub will form subject for a special report in the near future.

A New Moth-pest of Cane.

We have to record another addition to our lepidopterous pests of sugar-cane, viz.:—*Spodoptera Mauritia* (Bois.) Hampson, one of the so-called grass or army worms, which affects cane in Hawaii; where, before the introduction of the mynah bird, it was reported that whole fields of cane were often completely destroyed.

The eggs of this noctuid moth are laid in batches of an oblong or circular outline, consisting of sixty or more eggs deposited side by side and covered with a pinkish-brown felted mass of hairs taken from the body of the insect. Each female probably deposits in all from 350 to 400 eggs, affixing the batches to leaves of bushes, ceilings, walls, &c., but usually in situations immediately over or close to herbage, and the tiny larvæ upon hatching drop down on threads of silk until reaching grass blades. About eighteen days later, when fully grown, they measure 1¾ inch in length, and are then greenish-brown, with yellowish subdorsal and spiracular bands, the former having a dark line on the lower edge, and the latter being placed just below spiracles. The anterior dorsal portion of each body segment excepting the first encloses two triangular black patches, which are very variable, and in some specimens appear as short thick streaks. Spiracles, dark-brown; ventral surface greenish-yellow; head greenish-brown, with face yellow, mandibles dark red. Body cylindrical, tapering slightly towards each end, and bearing a few scattered black hairs.

Pupation takes place underground, this stage occupying a period of three weeks.

Caterpillars of this grass-worm were observed by the writer defoliating cane that was growing in cages used for breeding tachinid fly parasites.

Fortunately this new moth-pest is of very minor importance at present, and not likely to prove troublesome in the future.

It makes the eighteenth lepidopterous insect observed injuring sugar-cane in Queensland; and is probably controlled naturally by a number of parasitic and predaceous enemies.

GRAPE CULTURE IN QUEENSLAND.

By ALBERT H. BENSON, M.R.A.C., Director of Fruit Culture.

In the course of the past twenty-five years a great deal of very useful information and sound advice relating to the culture of the grape in this State has appeared from time to time in the *Queensland Agricultural Journal*, as well as in the form of special bulletins.

In the early days of the *Journal* Mr. E. H. Rainford, then Queensland's viticultural expert, contributed a number of excellent articles on all branches of the industry, and his writings were followed by those of Mr. Chas. Ross, late Instructor in Fruit Culture, who placed on record a description of many varieties of grapes that have been tested in this State, as well as the districts most suitable for their culture. Mr. Ross also contributed useful advice on the culture of grapes and the methods of pruning best suited to the several varieties. In addition to the information supplied by these departmental officers, there are many references to grape culture and wine making scattered generally throughout the back numbers of the *Journal*, including a very interesting series of articles by Mr. Gattino, of Charleville.

Matter relating to viticulture is so widely distributed among departmental publications that it is impossible for a beginner to obtain the instruction he requires in a readily available form. It is therefore my intention to endeavour to condense the information that has previously been given in departmental publications and issue it in pamphlet form. We are constantly receiving inquiries from persons who have recently taken up agricultural or horticultural pursuits and who do not possess even the most rudimentary knowledge of the conditions required for the successful culture of the grape or of the treatment it requires; and it is to help these new growers that I am preparing this pamphlet.

As I am writing more for the beginner than for the expert vigneron, it is advisable to start from bedrock, and this necessitates a knowledge of the origin of the grapes which are grown in this State.

All commercial varieties of grapes belong to the genus *Vitis*, of the natural order *Ampelidæ*, and several species belonging to this genus are cultivated.

Of the genus *Vitis* the species *Vinifera* is by far the most valuable and the most widely cultivated, as it embraces all our so called European varieties and includes all the best wine, table, and drying grapes. The home of *Vitis vinifera* is in Persia and Armenia, and from there it spread all over Europe and eventually to all the temperate and semi-tropical parts of the world. It does not thrive in the tropics. It is a deciduous plant, and therefore requires to be grown in a climate having a sufficiently cold winter to permit of its undergoing a complete rest. It can stand great summer heat, and thrives in hot dry climates when grown in a suitable soil, which is kept in a state of perfect tilth, even though there is little or no summer rainfall, provided there is a sufficiently good winter rainfall; but when this is lacking irrigation is necessary.

At the same time, it can stand many degrees of frost when in a dormant condition, although it is very easily injured by frost during the period of active growth.

The grapes belonging to this species, therefore, require a sufficiently cold winter to undergo the necessary rest and a warm, dry temperature when the fruit is ripening. A wet climate is not suitable.

It will thus be seen that the purely coast districts of Queensland are not the most suitable in which to grow *V. vinifera*, as the winter temperature is too high, especially in the more northern parts, where also the summer is frequently so moist and humid that it is conducive to the development of fungus diseases, but not favourable to the proper development of the sugar contents of the fruit. For this reason, it is only when we have a hot and dry summer on the coast that we can grow certain varieties of *V. vinifera* to perfection, as under normal climatic conditions it is only in a very few favoured localities and by the exercise of especial care that these varieties can be grown successfully.

As one goes back from the coast the conditions improve, and as soon as the main coast range is crossed in the southern half of the State the growing of many varieties of *V. vinifera* is possible, though several kinds of wine, table, and drying grapes that are susceptible to fungus diseases require to be grown even further west. This refers particularly to the growth of drying grapes, as, in order to produce a good raisin, sultana, or other dried grape, it is essential that the grape shall develop a very high percentage of sugar in its juice, and it can only do this in a hot and dry climate. This accounts for the excellent raisins and sultanas produced in the Murray River districts of Victoria and South Australia, where the normal summer conditions are hot and dry.

Certain varieties of *V. vinifera* do very well in the Central district, and Westwood, which is only some 30 miles west of Rockhampton, produces excellent Muscats, both black and white, as well as many other good varieties of table grapes. Many varieties also grow to perfection on the Peak Downs, desert country, and even further west, when given the necessary care and attention. In Northern Queensland a few varieties can be grown successfully at Charters Towers, Pentland, and even further inland; but they cannot be grown on the coast and do not succeed well in the Cairns Hinterland, even at high altitudes.

It will thus be seen that the successful cultivation of varieties of *V. vinifera* is confined to localities in which the climatic conditions are favourable for its growth, and that it is unwise to grow them elsewhere. Thousands of cuttings have been planted from time to time under totally unsuitable climatic conditions, all of which have proved a complete failure. Despite this experience, similar varieties are still being planted year by year under similar conditions. Failure under such conditions is inevitable, and it is a strange fact that many persons refuse to accept well-known facts until they are proved by their own experience.

Grape vines belonging to *V. vinifera* are easily distinguished from other species of *Vitis* by the leaves, which are more or less deeply lobed and of which the edges are toothed or serrated; the leaves are also shiny when young and generally smooth. The wood is stouter and the nodes or joints much nearer together than in other species. The skin of the fruit adheres to the flesh, which is juicy and firm, and the seeds are of a different shape to those of other species.

There are very many individual varieties of vinifera the fruit of which varies widely in size, colour, flavour, period of ripening, and production. As already mentioned, all the best drying, table, and wine grapes belong to this species. Several wild species of Vitis have been cultivated in America and imported varieties have been grown in Queensland for many years. They are all included under the general heading of American grapes and have proved capable of being grown under conditions that are by no means favourable for European varieties, for not only can they be grown successfully on our Downs country but also on the country lying between the Downs and the coast, as well as the actual coast country, excepting our most tropical districts, where no variety of cultivated grape is found to thrive.

American grapes belong to four species ("American Grape Growing," Husmann), viz.—

1. *Vitis labrusca*, the Northern Fox grape.
2. *Vitis æstivalis*, the Summer grape.
3. *Vitis cordifolia* or *V. riparia*, the Winter or Frost grape or the Riverside grape.
4. *Vitis vulpina*, the Southern Fox grape.

In addition, there are several other species of Vitis of which there are no cultivated varieties. All American grapes are more or less resistant to the fungus diseases that attack European grapes, and they will thrive in a more humid climate. Some varieties, and particularly hybrid varieties, either pure American hybrids or American-European hybrids, are also very resistant to phylloxera and are not injured to any appreciable extent by this destructive insect; still they are not immune, as there is no such thing as an absolutely blight-proof stock. Several of these hybrids are used as resistant stocks on which to graft varieties of *vinifera* for which purpose they are admirably adapted, as many of them are very vigorous growers and possess a fine root system. American grapes are distinguished by their leaves being entire and not lobed, and being always more or less downy or felted on the under side; by their long jointed thin wood and frequently rampant growth; and by the skin of the fruit separating readily from the flesh, which is of a slimy nature and has more or less of a foxy taste, much more noticeable in some varieties than in others.

American grapes are of considerably less value than the better European varieties; still they are valuable to this State in that they can be grown successfully in the coastal districts where other grapes fail.

A large number of American grapes have been introduced into this State, of which the following varieties are recommended:—

Labrusca type: Goethe, Iona, Martha, Wilder, Improved Isabella, or Pierce.
Æstivalis type: Herbemont, Lenoir.
Cordifolia type: Elvira.
Vulpina type: Scuppernong.

Of these varieties, Lenoir is only valuable for wine making. It has dark purple flesh, and its juice is so dark that it is valuable for giving colour to red wines; and Scuppernong, though highly spoken of in the Southern States of America, has so far never been grown successfully here, though our coast climate should suit it.

SOILS SUITABLE FOR GRAPE CULTURE.

Grapes can be grown on nearly every kind of soil, provided it possesses good natural drainage and has no hard-pan or cement underlying the surface soil. Good drainage is essential, as no grape vine will thrive with stagnant water at its roots.

Good free loams, sandy loams, alluvial loams, and even fairly heavy loams having good drainage are all suitable for grape culture; but the best soil is a deep free warm loam, either of a granitic, basaltic, sandstone, or limestone origin or of an alluvial nature.

Very rich soils are not as a rule suitable, especially in the coast districts, where the rainfall is heavy, as the vines grown on them tend to produce wood rather than fruit and are more liable to disease.

The dominant plant food of the vine is potash; consequently granitic soils rich in potash-yielding felspar, such as those of parts of the Stanthorpe district, are noted for the quality of the fruit they produce, and the sandy soils of our Western country, which also contain a supply of potash in an available form, produce fruit of high quality both for wine and table use. A high sugar content in their juice is developed under the hot and dry conditions that govern their growth.

Soils rich in lime are also very suitable for grapes, but as already stated any good, free, well-drained, loamy soil will grow good grapes if the land is properly prepared prior to planting and the vineyard is looked after when planted.

Situation of Vineyard.—In districts not subject to late spring frosts the situation of the vineyard is of very little importance—in fact, provided all other conditions are satisfactory, the more level the land is the better. Where late spring frosts, however, have to be taken into consideration, such as in the Granite Belt, the best situation is one well protected from all heavy and cold winds and that does not face the rising sun, so that it will be some way above the horizon before its rays actually strike the vineyard.

PREPARATION OF THE LAND.

This is summed up in one word—it must be *thorough*. Old writers on the grape always give very explicit instructions regarding the preparation of land prior to planting the vines, both when the vines are grown under glass and in the open. In the case of the former the soil of the bed in which the vines are planted is very carefully prepared or compounded and perfect drainage is provided, and in the latter the soil is trenched at least two spits deep and brought into a very high state of tilth. In the early days of grape-growing in Australia trenching the soil was considered essential, but experience has shown us that it is not necessary and that the heavy expense incurred is not warranted. The land for the vineyard must be thoroughly cleared—that is to say, all trees must be properly grubbed out and all roots run to a depth of at least 18 in. from the surface, deeper if possible, so as to permit of the land being ploughed as deeply as the surface soil will permit. The land should thus be subsoiled to at least 18 in., and deeper if it is possible to procure the power necessary for the work. After clearing, running all roots, and burning off, the land should be ploughed and cross-ploughed as deeply as the surface soil will permit; but the subsoil should not be brought to the surface. The soil proper should then be worked down fine and brought into a good state of tilth. It should then be again ploughed with a single-furrow plough, and a strong subsoil plough should follow in the furrow and break or stir up the subsoil as deeply as the power available will permit, but no subsoil should be brought to the surface. A powerful single-disc plough with a large disc 26 to 30 in. in diameter, followed by a very strong subsoil plough fitted with a bull-tongue share, makes an excellent combination. Land so prepared encourages the deep rooting of the vine—a very important consideration in our climate, where we are subject to long dry spells and depend mainly on intensive and deep cultivation to maintain the necessary supply of moisture in the soil.

Surface roots are the first to suffer during a dry spell, and further they are in the way of the cultivation that is so essential for the retention of moisture.

As already stated, the preparation of the land must be *thorough*. It may cost a little more at the start, but it will pay handsomely in the long run. "Good enough" is not *good enough* unless it is *thorough*. Many a vineyard is spoilt by planting the vines before the land is in a fit state to receive them.

PLANTING.

Having prepared the land for the vineyard as described, it is ready for planting, but the actual planting should not take place until the sap starts to rise in spring, for if planted then the cuttings will develop roots at once and start into growth very quickly; whereas if planted whilst the cuttings or vines are completely dormant there is always a chance of their drying out before starting growth. Given sound, well-matured cuttings and the land in perfect tilth, every cutting should grow, if

properly planted, at the right time. If unrooted cuttings are used, and they are by far the most satisfactory if they are properly treated—that is to say, if they have been cut from well-matured, healthy wood that has not been allowed to dry out—they are best planted with a bar. The method of doing so is as follows:—One man makes a hole in the soil of sufficient depth to take the cutting, and a second man places a cutting in the hole and holds it with one eye at the surface of the ground and one eye only above the ground. The first man inserts the bar into the soil at an angle a short distance from the cutting and then pushes the soil with the bar towards the cutting, thus closing the hole first made and tightening the soil all round the cutting. The soil must be quite firm all round the cutting and at its base, otherwise the cutting will dry out. A properly planted vine should be set so firmly in the soil that it can only be pulled out by the exercise of considerable force. As the bar is removed from the soil, the second hole made should be filled in with the bar. One of the greatest mistakes that is frequently made not only by beginners, but by older vignerons, is to leave far too much of the cutting out of the ground; 2 in. or 3 in. is ample, and yet one frequently sees more than 1 ft. left in the air to dry out. It must be remembered that no matter what type of pruning is to be eventually followed, only one cane coming from as near the surface of the ground as possible is required to form the future main stem of the vine. If rooted vines are planted instead of cuttings, they require very careful treatment and handling, for if the roots are exposed to the air for any time they are seriously injured.

On the receipt of rooted vines from the nursery they should be examined very carefully and all surface roots should be removed, only the roots that have started from the base of the cutting being allowed to remain, and these should be shortened back to a couple of inches in length. All the previous year's growth of wood should be pruned away excepting the best and strongest cane, which should be cut back to not more than two eyes in length, and from one of these eyes the cane destined to form the future main stem of the vine will be produced. Rooted vines cannot be planted with a bar, but if the land has been prepared as described a comparatively small hole will suffice. The vine should be set at about the depth at which it was growing in the nursery, and the soil should be packed firmly round it in order to permit its drying out. If the soil is very dry, a little water can be placed in the bottom of the hole at the time of planting, so that the base roots will come in contact with the moisture, and fine dry soil should then be used to fill in the hole. The distance apart at which to plant vines depends on the nature of the soil, its power to retain moisture, and the rainfall of the district in which the vines are grown.

European vines are grown both on a trellis and in the bush form, the latter with or without stakes as may be required; but American grapes must be trellised.

European grapes when trellised should be planted at from 6 ft. to 8 ft. or even more apart in the row and not less than 10 ft. between the rows, but when grown as a bush they should be planted on the square, not less than 8 ft. by 8 ft. or, better still, 10 ft. by 10 ft. and even wider planting in hot, dry districts. Don't crowd your vines; it pays to give them plenty of room, especially in dry seasons. American grapes require more space, and should be planted 12 ft. or more apart in the row, as many varieties are strong growers.

QUEENSLAND TREES.

By C. T. WHITE, F.L.S., Government Botanist, and W. D. FRANCIS, Assistant Botanist.

No. 11.

YELLOW-WOOD (*Flindersia Oxleyana*).

Unlike a large number of our scrub timbers, the yellow-wood is well known, and has been used a good deal for coachbuilding, railway carriage frames, and general joinery work. The trees attain 140 ft. in height and a barrel diameter of about 3 ft. As a rule the barrel is not flanged. The bark is grey or greyish brown, very scaly, and is shed in oblong pieces; when cut, the outer part is seen to be brown and the inner part dull yellow; it measures about ¾ in. thick on a tree with a barrel diameter of 2 ft. 2 in. It has been observed that the trees flower in December and January. The yellow-wood is not found growing naturally outside of Australia, and has been observed in scrubs of the coastal area from the Richmond River, N.S.W., to Gympie. The photograph of the capsule shows that this species is allied to the crow's ash and the Queensland maple, both of which also belong to the genus Flindersia. As an ornamental tree the yellow-wood deserves a prominent place in parks, gardens, and streets, but up to the present it has been almost entirely neglected in this respect. The accompanying photographs and the field notes given above will enable the reader to recognise the tree if it grows in his district.

Photo. by the Authors.]

PLATE 72.—THE YELLOW-WOOD (*Flindersia Oxleyana*), IMBIL SCRUB.

PLATE 73.—THE YELLOW-WOOD (*Flindersia Oxleyana*).

A.—Seed. B.—Placenta. C.—Capsule. C, natural size; remainder to scale.

ANSWER TO CORRESPONDENT.

F. C. MOLLER, Teviotville.

In reply to your letter of 12th May, asking for advice as to the advisability of laying down a concrete floor waterproofed by the addition of oil, this Department communicated with the Public Works Department on the subject, and received the following memorandum:—

"*RE* WATERPROOFING CONCRETE BY ADDITION OF OIL.

"The oil used should be of a heavy, viscous nature, of mineral origin. A suitable oil could probably be obtained from the Vacuum Oil Company.

"The concrete proportions should be:—1 bag cement, 2½ cubic feet sand, and 5 cubic feet broken stone; or, 1 bag cement, 1½ cubic feet sand, and 6 cubic feet graded gravel. Mix the concrete as usual, and after the water has been added, and the concrete turned twice wet, then add the oil and turn twice again, raking the heap while the concrete is being shovelled. The oil will be quickly emulsified and thoroughly mixed with the concrete.

"The oil should be in the proportion of one-tenth by volume to the cement used. The water employed in mixing the concrete should be clean rain water.

"The resulting concrete will be dense and impervious to water, but it is uncertain as to whether it would resist the action of animal urine if used in cow bails."

SCIENCE NOTES.

BY EDMUND JARVIS, Entomologist, Bureau of Sugar Experiment Stations.

Under this heading it is proposed each month to record discoveries likely to interest scientists and relating to insect pests of sugar-cane and their parasites.

EARLY STAGES OF *MACROSIAGON CUCULLATA*, MACL.

A hyper-parasite of the above genus—viz., *M. pictipennis*, Lea—has, since the year 1915, been considered an enemy of our useful digger-wasp parasites (*Campsomeris tasmaniensis*, Sauss., and *C. radula*, Fabr.).

Nothing, however, was known respecting the life-cycle of these curious beetles until quite recently (December, 1921), when Mr. W. Cottrell Dormer, Assistant Entomologist, had the good fortune to observe specimens of *cucullata* in the act of ovipositing on the under-surface of leaves of *Ficus opposita* and *Urena lobata*.

The eggs, which are white, of elliptical form, and measure 0.45 x 0.15 m.m., numbered a hundred or more, and were placed close together but without definite arrangement amongst the hair of the leaf, over an area of about 1½ square inches. During the period occupied by the egg stage they were kept under quite dry conditions in glass tubes, and a fortnight later had commenced to darken, becoming black and finally hatching after 17½ days.

The minute and active triungulin, representing the first larval stage (figs. 1, 2), resembles in general appearance and structure that of a closely related European species (*Rhippiphorus paradoxus*), and, like that insect, probably frequents flowers visited by hymenoptera in the hopes of attaching itself to some suitable wasp and being carried into its nest. If successful, it probably waits until the egg of its host hatches, and then enters the body of the young maggot. A Campsomeris wasp was placed by us for a few seconds in a large test-tube containing about 25 triungulins, and then put under chloroform. Examination revealed numbers of the latter tightly embracing various hairs on the tarsi, clypeus, neck, pronotum, &c., of the wasp. Upon reviving, and discovering the presence of these minute enemies, it endeavoured to brush them off, but only succeeded in killing one and removing two others. Subsequently, these triungulins were carried underground by the host, and after oviposition had taken place one of them remained on the egg attached to the paralysed grub for three days, making no attempt to pierce the chorion, but apparently awaiting the appearance of the maggot of the wasp. The triungulin itself is a black and almost microscopic insect, barely visible to the naked eye, measuring 0.53 x 0.16 m.m.

By the aid of a sucker situated ventrally on the anal segment, it is able when necessary to stand on its tail, thus leaving all legs free, when about to lay hold of wasps visiting the flowers.

1.—Unflattened specimen, showing convexity of dorsal surface.

Photo. W C. Dormer.]

2.—Specimen mounted in balsam (magnified 153 diameters).

PLATE 74.—TRIUNGULIN OF MACROSIAGON CUCULLATA, MACL.

FRUIT FLY INVESTIGATIONS.

[SECOND PROGRESS REPORT.]*

By HUBERT JARVIS, Entomologist in Charge of Fruit Fly Investigations at Stanthorpe.

The Minister for Agriculture and Stock (Hon. W. N. Gillies, M.L.A.), has made available the Second Monthly Report, dated 15th April, of Mr. Hubert Jarvis, Entomologist in Charge of Fruit Fly Investigations at Stanthorpe, received through Mr. Henry Tryon, Entomologist-in-Chief.

In forwarding the following report, I would direct attention to the transference—as narrated therein—from Brisbane to the "Granite Belt" of Southern Queensland, of the fruit fly parasite Diachasma Tryoni (Cameron) Silvestri as being the first of several hymenopterous parasites of fruit flies that it might be found practicable to utilise in controlling these "pests" both there and elsewhere in the State.

(*Sgd.*) *HENRY TRYON,*
Entomologist-in-Chief.

This insect, originally discovered by this Office in 1892 *and referred at the time to the genus Opius (Bræonidæ, Hym.) (Vide Tryon, H., "The Parasite of the Fruit Maggott," Trans. Nat. Hist. Soc. Qld. I. pp.* 8-9, *Brisb.* 1895) *was in* 1911 *named Opius Tryoni by Cameron, but placed more correctly in the genus Diachasma, by F. Silvestri, in* 1914.

Already in 1910 *W. B. Gurney published important information regarding its parasitic habit, in New South Wales, confirming what we had previously stated as to the extent that this was displayed in Queensland in relation to our commoner fruit fly. In* 1913 *the abovementioned Italian savant conveyed this Diachasma to Honolulu, an action on his part that led to its general distribution throughout the Hawaiian Islands, for since then it has been continuously bred and distributed.*

Notwithstanding in realising this event it was only liberated on August, 1914, *it was by the end of this year found already destroying the fruit fly of coffee (C. Capitata) in the Kona Valley to the extent, in some instances, of* 40 *per cent. And, although its services in parasitising fruit fly maggots in the larger fruits are limited, by reason of the shortness of its ovipositor (relatively long, however, for a fruit fly braconid) it is considered by us that it should prove useful in reducing the strength of the earlier broods of fruit flies at Stanthorpe, that are yielded by maggots infesting cherries and certain small early ripening plums.*

(*Intld.*) *H.T.*
20-4-22.

FIELD OBSERVATIONS.—PERIOD, 14TH MARCH TO 14TH APRIL, 1922.

Wintering of Fruit Fly.

The search has been continued for the pupæ of the fruit fly (*Dacus Tryoni*) in various districts, under the following orchard trees:—Apple, peach, nectarine, plum, and apricot, whose fruit crop (three weeks or more gathered) had been badly infested with fruit fly maggots.

The soil to a depth of 1 foot right around individual trees has been carefully sieved and examined, but no live pupæ have been so far encountered. The ground under two large apricot trees, "whose entire crop was ruined by fruit fly maggots," (*vide* W. Warry, Esq., Stanthorpe) gave, too, negative results, although many empty pupa cases were secured.

Activity of Fruit Fly.

The Queensland fruit fly (*D. Tryoni*) was on the 20th March, 1922, observed in numbers ovipositing in ripe quinces at The Summit; ten flies were captured on the fruit in about half an hour, one of the number proving to be a female specimen of *D. Tryoni var. Solani* (The Solanum fruit fly.

The quince on which this fly was captured is at present under observation, in this office, and it will be interesting to see if the "Solanum" fly will (contrary to our present belief) attack cultivated fruit.

Two female examples of the Solanum fly (*D. Tryoni* var. *Solani*) were found at Ballandean (Mr. D. Watts's orchard) in a "Magnet" trap baited with "Magnet" lure. This trap had been on the trees for about eight weeks (*vide* D. Watts, jnr.).

* Early in February of this year Mr. Hubert Jarvis, of the Division of Entomology, Department of Agriculture and Stock, was appointed to investigate the fruit-fly problem in the Granite Belt. His first progress report was published in the May Journal.

Longevity of Fruit Fly.

In order to ascertain how long the fruit fly will live, 100 are being kept in large glass jars in the laboratory, and fed twice daily.

These flies, hatched from 3rd to 8th April, 1922, are all at present alive and active.

Destruction of Maggot-Infested Fruit.

Some considerable time has been devoted to examining "dumps" where fruit has been burnt, with a view to determining the safety or otherwise of this method of dealing with maggot-infested fruit.

Under one such dump, where a large quantity of peaches had been burnt, forty pupæ were secured. Most of these pupæ were found about ½ an inch deep in hard soil, and under the space occupied by the centre of the fire; but some, however, were concealed under logs and other suitable cover at the edges of the fire. From these forty pupæ, taken 23rd March, 1922, twenty-six fruit flies hatched between the 5th and 10th of April, 1922.

This seems to indicate that burning fruit on the ground is not a reliable means of destruction, as many of the fruit-fly maggots would, on feeling the heat, if not earlier, escape from the fruit and enter the soil, therein pupating, and in due course giving rise to more fruit flies.

The plan adopted by many orchardists of first laying a timber foundation, on which to deposit the fruit, and then building the fire on top, should prove more effective than when this procedure is not followed, although I am convinced that a good percentage of maggots would escape even then.

A practice most strongly to be condemned (fortunately only one instance has come under my notice) is the dumping of fruit on *uncleared land* (adjoining the orchard) and covering the same with brushwood, omitting any further action.

The instance referred was brought to light at The Summit. A large quantity of fruit had been carted to the spot and dumped there, sticks and brushwood having been placed on top, presumably with the object of screening it from view. A large number of living pupæ were found in the soil under the fruit, but from by far the bigger number some thousands of flies had already emerged, leaving only an abundance of empty pupæ cases.

It is difficult, indeed, to believe that any orchardist could be guilty of such a practice, especially being aware (as he must well be) of the serious situation created by the fruit-fly as a pest in the Granite Belt, and also of the co-operative effort being made by all intelligent growers (the majority) to control this pest.

While such a procedure is possible, however, little hope can be entertained of a practical control of the fruit-fly in the Stanthorpe area.

Drowning Fruit-fly Maggots.

Experiments have been made in order to determine how long the maggots and papæ of the Queensland fruit fly (*D. Tryoni*) will live (immersed) in water.

Fruit-fly maggots and pupæ have been placed in glass jars and covered with 2 to 3 inches of water for three, four, and five days.

Results prove that maggots and pupæ perish if immersed in water for four or five days.

Data relating to this experiment will appear in a later report.

The above experiment would suggest drowning as a satisfactory and safe way of dealing with the maggots in infested fruit.

Any old tank or large barrel would serve the purpose. The fruit should be covered with at least 2 inches of water, and left for five days. It should then be taken out and ploughed in for manure (if so desired) without any danger of fruit flies hatching.

Burying the Maggot-Infested Fruit.

As regards burying fruit, it has yet to be proved how far the fruit fly (*D. Tryoni*) will burrow through soil or sand after emerging from the pupa. Instances are on record (*vid.* Annals of Ent. Soc. America, vol. vii., No. 3, 1914) of the melon fly (*D. Cucurbitæ*) burrowing upwards through 2 feet of wet sand.

Experiments to test this in relation to our own fly (*D. Tryoni*) are being carried out, and results will be available later.

CONTROL MEASURES.

Natural Enemies.

On the 25th of last month a visit was made to Brisbane and districts with a view to introducing to the Stanthorpe area the fruit-fly parasite (*Diachasma Tryoni*, Cam. (*Braconidæ*)). After conference with the Entomologist-in-Chief (Mr. H. Tryon), three days were spent at Goodna collecting this parasite, with no small success.

About forty specimens were secured alive (the majority being female) and also a good deal of infested fruit likely to yield additional specimens.

These parasites were successfully transferred in glass tubes to this district, with only a few casualties. Twenty were liberated, and the remainder kept for experimental work and for special observation.

This parasite (*Diachasma Tryoni* Cam.) is a small, active, red-coloured wasp, 8 to 9 mm. (just over $\frac{1}{3}$ inch) long. The ovipositor (egg-layer) in the female is almost as long as the rest of the body. The insect is furnished with ample wings and very long sensitive antennæ.

Opius Tryoni Cam. may be seen on warm days flying around and lighting on maggot-infested fruit. If watched closely it will be seen to pass with quite short, jerky movements over the fruit, touching the same from time to time with its waving antennæ, its whole attitude suggestive of listening. When, possibly, by a sense of hearing or some other instinct, it has located the fruit-fly maggots beneath the skin, it stops, raises its body to a perpendicular position, and inserts its ovipositor in the fruit, working it in by downward movements of the body until it is buried about $\frac{1}{8}$ of an inch deep in the flesh. It then, by an upward movement, withdraws its ovipositor, cleans it with its posterior pair of legs, and almost immediately repeats the operation at another spot.

So persistent and active are these little wasps that specimens under observation have made as many as twenty punctures in the fruit in twenty-five minutes, the process taking from $\frac{3}{4}$ to $1\frac{1}{4}$ minutes. It is probable that some punctures serve as probes to locate the prey.

The *Opius* can only reach the maggot when the latter is close underneath the skin (*i.e.*, full grown and on its way out of the fruit), or approaching the surface in breathing.

An effort is being made to breed these parasites in the laboratory, and it is hoped that a control method of value may thus result.

Under these laboratory conditions as many as five of these parasites have been observed ovipositing at once on one individual fruit.

(*Note.*—A pressing need at present is an insectary, where these and other insects could be bred and studied under natural conditions.)

Trapping and Luring.

Owing to the lateness of the season and the almost entire absence of fruit, trapping experiments in the field, by means of lures, no longer give good results, although a few flies are still being caught.

Five fruit flies submitted on 8th April, 1922, for identification by Mr. Schneider, of Broadwater, and said to be caught with a new lure (his own discovery) proved to be all female examples of *D. Tryoni*, the Queensland fruit fly.

Useful Insects.

The so-called "grey maggots," destroying the woolly aphis of the apple and doing very good work indeed in this direction, prove to be the larval forms of two species of Syrphidæ ("Hover flies") *Syrphus viridiceps*, Macq. and *Syrphus pusillus*, Frog.

Both species are renowned (as are so many members of this family) aphis-eaters. The adult flies (bred in this office) are handsome insects of a bronze-black colour, the body banded with bright yellow.

The Hover fly lays its egg among or close to the woolly aphis (*Schizoneura Lanigera*), and the young larva, on hatching, immediately starts feeding on the abundance of food surrounding it that these insects constitute.

When full grown (above $\frac{1}{3}$ an inch long) it seeks a retired spot and turns to a pyriform (pear-shaped) dark-brown chrysalis or pupa, from which in due course it comes as the adult Hover fly.

Unfortunately, the Hover flies also have their enemies, the two species referred to being attacked and parasitised by a small braconid wasp. This happens to these flies when in the maggot stage and whilst they are too feeding on the woolly aphides. Two specimens of this Hover fly parasite have been bred in this office.

Tomato Fly.

As was anticipated, maggots found in tomato and bred in the laboratory prove to be the tomato fly (*Lonchaea splendida*), and not a true fruit fly (Trypaneidæ).

Office Work.

I am indebted to the following orchardists and others for donations to the official collection of economic insects:—Mr. W. Ranger, Mr. A. Paget, Dr. J. F. Roberts, Inspector J. Henderson, Inspector F. Williams, and Mr. F. Sellars (Stanthorpe).

It will, it need scarcely be stated, be of the greatest assistance to us to receive from orchardists and others interested, specimens of all insects that come under their notice, whether useful or otherwise; thus, and by our own efforts also, will a valuable collection of economic insects be built up, and be of much service, both as a means of study and for future reference.

GENERAL NOTES.

The Secret of Potato-growing.

"The great secret in potato-growing," continued Mr. Hiam, "is to get the proper seed, and the system adopted in Jersey could be followed with advantage. The potato-growers there secure all their seed from their own stocks. The greenest and most vigorous plants are dug up for seed when the potatoes have reached about three-quarter growth. These potatoes are put in boxes, and left in the sun until they get thoroughly green and hard, when they are put away in a shed, where they will be secure from frost for the winter. They are examined about every ten days to see that they are not sprouting too much, and this is prevented by giving them more air, or moving them into a cooler position. It is advisable not to let them grow sprouts more than a quarter of an inch in length. Through getting these potatoes green and hard in the sun, when planted, wire worm and other pests will not interfere with them, and should the land be wet, they will not rot as other potatoes do. Also, when they are growing they are much stronger to resist frost. There is no comparison between seed saved in this manner and that saved from potatoes that have been allowed to ripen. Potatoes for this purpose must be lifted while they are in vigorous growth, and before any sign of blight appears, as once this disease has shown itself in the haulm the potatoes would not keep if dug green, as the spores from the leaves and the spores on the land immediately affect the tuber that is dug in an immature state. I have no hesitation in saying that the grower who carries out these instructions will increase his crop by at least 40 per cent."

Improvement of Wheat-growing.

At a recent meeting of the Provisional Council of Agriculture a scheme for the betterment of the wheat-growing industry was submitted by Mr H. C. Quodling (Director of Agriculture) for consideration by the Council. The Council approved of the general principles of the scheme, and, recognising the importance and urgency of giving effect to the proposals, authorised the Wheat and General Agricultural Standing Committee to take immediate action. With a view to the initiation of the proposals prior to the conclusion of the present season's planting operations, the Committee met the members of the State Wheat Board and Mr. R. E. Soutter (Manager, Roma State Farm) at a special meeting at Toowoomba.

The proposals submitted by the Director of Agriculture were adopted, and provided, briefly, as follows:—

(1.) That the Wheat Board co-operate with the Department of Agriculture in encouraging the cultivation of certain types of wheat which combine desirable field characteristics with good milling and nutritive qualities, and in eliminating approximately two-thirds of the existing varieties which have proved less reliable;

(2.) That the Wheat Board undertake the distribution of the supplies of seed wheat grown by the Department which have been proved rust resistant and reliable in regard to yields;

(3.) That the approved varieties be distributed for planting in specified classes of soils only;

(4.) That, subject to conditions laid down in regard to the cultivation of such varieties, the Wheat Board purchase on special terms the resultant crop of grain if suitable for seed purposes.

Seeing that the Board controls the purchase and sale of all Queensland-grown wheat, it was agreed that the operation of this scheme would effect a marked improvement in the wheat-growing industry, and that within a reasonable space of time high-class varieties specially suited to local conditions would be cultivated throughout the wheat-growing areas generally.

Organising Maizegrowers.

For many years there has been a steadily growing demand on the part of the maizegrowers of Queensland for some more organised method of marketing their produce. While the wheatgrowing areas are comparatively centralised, however, the centres of the maize industry are widely separated, large quantities being grown on the Atherton Tableland, and in the Burnett, the Downs, and other districts. It is thus apparent that the establishment of a central organisation to safeguard the interests of the whole of the growers of the State is a task of considerable magnitude. Some action, however, is urgently needed, and it will be of interest to the maizegrowers of Queensland to know that the problem in all its phases was considered by the Wheat and General Agriculture Committee of the Council of Agriculture at its first meeting in Toowoomba. After full discussion the Committee were of opinion that the problem is capable of solution, and that a complete organisation of the industry is possible. For the purpose of collecting full statistical information regarding production, it was agreed to ask the Department of Agriculture to circulate immediately a return form (approved by the Committee) on which growers will supply necessary details. When such information has been secured, the Committee propose to formulate a definite scheme for consideration by the Council of Agriculture.

Meat Ants as "Policemen."

Mr. Thos. Simond, Apple-Tree Creek, writes:—"I am only starting cane-growing, and have put in about an acre with hoe and mattock, and have noticed how quickly beef ants are on the job for wood grubs, worms, and other pests. Perhaps ants would be equally efficient as an aid to exterminating cane grubs."

Show Dates, 1922—

Show society secretaries are invited to forward for insertion in this list dates of forthcoming shows. Alterations of dates should be notified without delay.

Bundaberg: 1st to 3rd June.
Marburg: 2nd and 3rd June.
Brookfield: 3rd June.
Cairns: 7th and 8th June.
Gin Gin: 7th and 8th June.
Woombye N.C.A.H.S.: 7th and 8th June.
Mount Larcom: 9th and 10th June.
Gladstone: 15th and 16th June.
Rockhampton: 22nd, 23rd, and 24th June.
Esk: 28th and 29th June.
Mundubbera: 29th and 30th June.

Mackay: 30th June and 1st July.
Gayndah: 4th, 5th, and 6th July.
Nambour: 5th and 6th July.
Townsville: 5th and 6th July.
Charters Towers: 12th and 13th July.
Gatton: 12th and 13th July.
Proserpine: 13th, 14th, and 15th July.
Rosewood: 19th and 20th July.
Caboolture: 20th and 21st July.
Mount Gravatt: 22nd July.
Barcaldine: 25th and 26th July.
Crow's Nest: 26th July.

Pine Rivers: 28th and 29th July.
Wellington Point: 29th July.

Sandgate: 4th and 5th August.
Royal National: 7th to 12th August.
Belmont: 19th August.
Murrumbidgee: 22nd to 24th August.
Coorparoo: 26th August.
Kenilworth: 31st August.

Beenleigh: 1st and 2nd September.
Zillmere: 1st and 2nd September.
Gympie: 7th, 8th, and 9th September.
Wynnum: 9th September.
Imbil: 13th and 14th September.
Laidley: 13th and 14th September.
Sherwood: 16th September.
Rocklea: 23rd September.
Kilcoy: 28th and 29th September.

Esk Camp Drafting: 4th and 5th October.
Pomona, 4th and 5th October.
Southport: 6th October.
Enoggera: 7th October.

Biggenden District Agricultural and Pastoral Society: Thursday and Friday, 29th and 30th June, 1922.

BOWEN.—Bowen Pastoral, Agricultural, and Mining Association: F. Sellars, Secretary; Thursday and Friday, 27th and 28th July, 1922.

INGHAM.—The show dates of the Herbert River Agricultural Association have been altered to 11th and 12th August, 1922.

CERTIFICATES OF SOUNDNESS.

Certificates of Soundness were issued for the following Stallions during the month of May, 1922:—

Name of Stallion.	Breed.	Period for which Certificate was issued.	Owner's Name.	Owner's Address.
Battle Call ..	Blood	Life ..	E. J. Hayes ..	Harrisville
Warbelle ..	Blood	12 months	H. Weirer ..	Bright View, Lowood
Kim II. ..	Pony	Life ..	S. S. McCoombes	Church Hill, Ipswich
Black Eagle ..	Pony	Life ..	J. E. Hastings..	Silkstone, Ipswich
King Rufus ..	Pony	12 months	J. E. Reiser ..	Boonah
Colin Rufus ..	Trotter	Life ..	G. King ..	Salisbury road, Ipswich
Gold King ..	Trotter	12 months	W. Altmann ..	Glamorgan Vale, Ipswich

AN EXPERIMENT IN EGG PRODUCTION.

[From the "Journal of the Department of Agriculture," Union of South Africa.]

REPORT ON THE BUILDING UP OF TESTED LAYING STRAINS.

By J. J. JORDAAN, Poultry Instructor, Glen, Orange Free State.

This report gives my observations, conclusions, and remarks, and sets out the present position in connection with the experiment started at the Glen School of Agriculture in 1915-16 for building up tested laying strains of Speckled Sussex, White Wyandottes, and Silver Campines.

The accompanying table summarises the work done during the period 1st May, 1915, to 31st March, 1921, and while the actual output of eggs is only moderate, the lessons that have been learned are most valuable and form the first step towards the goal the experiment is intended to reach.

The Speckled Sussex and Silver Campines for the experiment were imported from England, and the White Wyandottes were procured from a South African breeder, as well as some other birds that were taken over from the Grootvlei Experiment Farm.

In-breeding of the closest possible nature was adopted up to the time dealt with by this report, so as to fix uniformity in all sections, such as type, colour, size, shape, and numbers in the eggs produced, as it was felt that these fixed characteristics could only be achieved by the above means. Very ordinary food was given the birds doing the test, anything of a forcing nature being most rigorously avoided; no meat or meatmeal was ever allowed, otherwise the numbers would doubtless have been considerably greater.

For the first year trap nests were used. In the second year the single pens were completed and occupied. These measure 20 ft. by 2 ft. 10 in., with house at the back 2 ft. 10 in. wide, 6 ft. deep, and 4 ft. 6 in. high, made of wood with galvanised iron roof. There is a wire-netting division in the house, each sixth division being of ceiling boards.

A nest is made of a paraffin box on its side, resting on bricks. On the top of the box is a bracket on which rests a perch; this passes through the wire-netting and, resting on the bracket on the box in the next run, serves as perching room for four birds, two in each run. The perch is removable, so is the nest, and the top of the nest (box) serves as a dropping board for the manure.

Water is provided in a small vessel suspended from the wire-netting division in the house above the roost. Admission to the house and run is through the back of the house, which is virtually the door.

Grain food is fed in a deep layer of litter on the floor of the house, the litter being kept in by a flap 12 in. high at the front and back of the house. Mash, green food, grit, charcoal, and lime food are given in a small paraffin tin, having hooks made of plain wire, suspended on the inside of the fence, at the front end of the run, a small hole being made in the wire-netting to admit the hand for this purpose. The tin is divided into three sections for mash and green food, grit and shell, and charcoal respectively.

From 1915 to 1919 attention was given solely to the three above-mentioned breeds, but in 1919-20 a start was made to test and build up the strains of some of the other breeds from the stock on the farm. Owing to the limited number of runs the following breeds only could be added:—Light Sussex, White Leghorns, Anconas, Barred Plymouth Rocks.

The result of the test with these, as far as it has gone, is also shown in the summary herewith.

To carry out the enlarged experiment meant placing two birds in a pen originally built for one, with resulting disadvantages, such as lower production, outbreak of vices, and earlier contamination of the soil in the runs. It was thought better, however, in the interests of the institution's stock as a whole to put up with these disabilities than to have no tested record of the producing ability of our breeding stock, for the constant purchase of birds from private breeders is not only expensive but certainly not conducive to the fixing of our own strains and their characteristics.

At the close of March last all the birds were removed from the pens to rest them for twelve months. The pens were dug over and sown with oats, it being intended to dig this crop in as green manure about September and then to resow with some other quick-growing plant which, in turn, will be again dug in about January, the runs to be again resown. It is thus hoped, by the end of next March to have the pens thoroughly fresh and as good as when first erected, if not better, and ready for another five years' occupation.

While a study of the summary shows nothing of a record, it reveals a marked improvement during the first four years in the production of the first three breeds started with, *i.e.*, in the number of eggs laid by the hens in each breed, both those laying the least and the most, together with the average of the numbers tested, showing an improvement each year. This is not quite so apparent or general in the case of the Speckled Sussex, yet improvement there is and of a marked nature, if the results of the first and fourth years (1915-16, 1918-19) are compared.

It is clear therefore that this method of testing and breeding to fix the characteristics aimed at in the strain, and of improving the general or average egg production of a flock or breed so as to render it a fixed strain, is sound.

The drop noticeable in the figures between the fourth and fifth years' records—1918-19 and 1919-20—is attributed to the following reasons:—

(1) The ground in the runs was becoming stale, and this affected the health and stamina of the birds and also their resulting output.

(2) In some cases signs were not wanting that a touch, or slight infusion of new blood, was being called for.

(3) A rigorous selection, not of the largest producers to breed from the previous year as had been done formerly, but of those robust, typical, only moderate layers of good sized eggs in preference to those that gave quantity of eggs lacking size was needed.

It was felt, moreover, that the uniformity first mentioned in the report was fairly well established, and more attention could now be given to the size of eggs produced; that, no doubt, was the main contributary reason for this drop.

For various reasons it was thought best to close the test at the end of March last. Thus the last period was a test for nine months only, but, comparing the results of all the breeds and remembering the state of the ground in the runs, the

records—if taken *pro rata*—again show an improvement over those of 1919-20. The size of egg also improved in this period, due to the matings in 1918-19 and 1919-20.

In spite of the handicaps mentioned, if the twelve-month record for 1915-16 and the nine-month record for 1920-21 are compared *pro rata*, a slight improvement is found, but that is nothing when the general uniformity of the birds and of the eggs now laid are considered.

There now exists in the three breeds first started with a firm foundation in certain fixed characteristics and uniformity. With the discriminate infusion of a little new blood this year, it is anticipated that the next five years' tests on fresh ground, and some knowledge of what is being bred from, will maintain the uniformity that has been fixed, and that the quantity of output will be further improved, but, it is hoped, not at the expense of the size of egg which, for the last two years, has been mainly kept in view.

It is yet too early to remark upon the results of the other four breeds being tested, than to say that the setback in the second year in the Light Sussex is inexplicable, except that the male bird used the first year was purely a show bird and lacked egg-producing qualities, which did not appear to be the case on external characteristics.

SUMMARY.

Year.	Breed and Variety.	No. of Hens completed Test.	Lowest Output from a Hen.	Highest Output from a Hen.	Average Output from Flock.	Remarks.
1915–16	Speckled Sussex.	10	47	140	93·4	Imported stock.
1916–17		3	61	101	82·66	" " First Progeny.
1917–18		10	83	201	135 6	Progeny of above.
1918–19		8	114	154	135	" " two above.
1919–20		12	63	132	101·75	Two birds started to a pen. Selection for improvement in size of egg started.
1920–21		12	25 *(cull)	103	70·92	Nine months' record only.
1915–16	White Wyandottes.	11	76	145	112·73	New stock started with.
1916–17		5	97	145	115·2	Birds bred on farm from above.
1917–18		9	112	196	161	Progeny from above.
1918–19		11	152	210	178·36	" " "
1919–20		9	87	177	124·33	Two birds started to a pen. Selection for improvement in size of egg started.
1920–21		11	77	145	107·36	Nine months' record only.
1915–16	Silver Campines.	12	29	118	67·75	Imported stock.
1916–17		6	56	115	84·33	" " First progeny.
1917–18		8	94	181	128·12	Progeny from above.
1918–19		11	125	204	164·91	" " "
1919–20		10	22†	179	122·2	Selection for improvement in size of egg started. Two birds started in a pen.
1920–21		7	54	113	95	Nine months' record only.
1918–19	Light Sussex.	3	166	212	193·33	Birds exchanged, origin unknown.
1919–20		11	50	85	64 36	Progeny of above.
1920–21		4	58	75	67	" " " Nine months' record only.
1919–20	White Leghorns.	20	142	210	172 55	Bred on farm.
1920–21		23	80	157	121·7	Progeny of above. Nine months' record only.
1920–21	Anconas.	5	101	122	114	Bred on farm. Nine months' record only.
1920–21	Barred Plymouth Rocks.	5	88	128	111·6	Bred on farm. Nine months' record only.

* Purposely tested to demonstrate that culls are useless to keep for students' education.

† Ruptured oviduct. Kept for same purpose as culled Speckled Sussex above.

REPORT ON EGG-LAYING COMPETITION, QUEENSLAND AGRICULTURAL COLLEGE, APRIL, 1922.

The nineteenth egg-laying competition held at the Q.A. College commenced on 3rd April. The competing pens number 70, 44 competing in the light section and 26 in the heavy section. In the case of 40 pens the birds are being tested singly, 28 being light and 12 heavy breeds. The following are the individual records:—

Competitors.	Breed.	April.
LIGHT BREEDS.		
*Bathurst Poultry Farm	White Leghorns	112
*W. and G. W. Hindes	Do.	108
J. H. Jones	Do.	104
*Geo Trapp	Do.	104
J. Purnell	Do.	101
*S. L. Grenier	Do.	97
H. G. C. Wenck	Do.	97
B. Hawkins	Do.	97
*W. A. Wilson	Do.	92
*O. Goos	Do.	92
*G. Williams	Do.	83
*T. Fanning	Do.	80
B. C. Bartlem	Do.	80
*Mrs. E. White	Do.	77
*N. A. Singer	Do.	76
A. Martin	Do.	73
C. H. Singer	Do.	72
A. Anders	Do.	70
E. Stephenson	Do.	69
*H. Fraser	Do.	65
*J. W. Short	Do.	63
*J. W. Newton	Do.	62
*W. Becker	Do.	60
Brampton Poultry Farm	Do.	59
*C. M. Pickering	Do.	59
*H. P. Clarke	Do.	56
E. Symons	Do.	56
T. H. Craig	Do.	56
G. H. Richardson	Do.	55
*R. C. Cole	Do.	55
*Mrs. L. Anderson	Do.	54
*C. Goos	Do.	54
N. J. Nairn	Do.	52
*J. M. Manson	Do.	52
*E. A. Smith	Do.	44
*R. Gill	Do.	40
*Oakleigh Poultry Farm	Do.	38
*R. C. J. Turner	Do.	36
H. Trappett	Brown Leghorn	34
*M. F. Newberry	White Leghorns	33
*Mrs. R. E. Hodge	Do.	29
*F. Birchall	Do.	29
*Thos. Taylor	Do.	6
Parisian Poultry Farm	Brown Leghorn	0
HEAVY BREEDS.		
J. Hutton	Black Orpingtons	130
Mrs. A. Kent	Do.	128
Wombo Poultry Farm	Do.	120
*A. E. Walters	Do.	113
*R. Holmes	Do.	97

EGG-LAYING COMPETITION—*continued.*

Competitors.	Breed.	April.
HEAVY BREEDS—*continued.*		
*R. Burns	Black Orpingtons ...	86
*Rev. A. McAllister	Do.	82
*Jas. Potter	Do.	80
V. J. Rye	Do.	72
Mrs. L. Maund	Do.	72
Mrs. A. E. Gallagher	Do.	71
H. B. Stephens	Do.	61
*H. M. Chaille	Do.	60
Jas. Hitchcock	Do.	59
R. Innes	Do.	51
*T. Hindley	Do.	44
*E. F. Dennis	Do.	34
*Parisian Poultry Farm	Do.	33
C. Rosenthal	Do.	23
W. Becker	Chinese Langshans ...	16
W. C. Trapp	Black Orpingtons ...	12
C. Doan	Do.	12
*J. E. Smith	Barred Rocks	11
*C. C. Dennis	Black Orpingtons ...	1
*Miss L. Hart	Rhode Island Reds ...	1
R. Burns	Silver-laced Wyandottes	0
Total	...	4,300

* Indicates that the pen is being tested singly.

DETAILS OF SINGLE TEST PENS.

Competitors.	A.	B.	C.	D.	E.	F.	Total.
LIGHT BREEDS.							
Bathurst Poultry Farm	14	16	17	23	23	19	112
W. and G. W. Hindes	19	17	20	15	18	19	108
G. Trapp	18	7	21	18	18	22	104
S. L. Grenier	14	13	16	17	17	20	97
O. Goos	16	11	12	24	15	14	92
W. A. Wilson	14	12	12	19	20	15	92
G. Williams	13	13	19	12	12	14	83
T. Fanning	16	14	8	17	18	7	80
E. White	20	10	8	9	17	13	77
N. A. Singer	5	10	17	21	10	13	76
H. Fraser	11	17	11	14	6	6	65
J. W. Short	16	9	10	18	1	9	63
J. W. Newton	15	16	8	5	13	5	62
W. Becker	0	6	19	14	5	16	60
C. Pickering	11	15	11	4	10	8	59
H. P. Clarke	14	0	12	5	15	10	56
R. C. Cole	7	16	21	4	2	5	55
C. Goos	9	5	6	9	7	18	54
Mrs. L. Andersen	10	1	8	15	10	10	54
J. M. Manson	15	4	5	6	14	8	52
E. A. Smith	12	2	9	11	2	8	44
R. Gill	9	3	3	2	7	16	40
Oakleigh Poultry Farm	0	1	1	11	5	20	38
R. C. J. Turner	4	0	13	10	3	6	36
M. F. Newberry	3	2	10	14	3	1	33
Mrs. R. Hodge	11	0	2	9	2	5	29
F. Birchall	1	4	2	10	3	9	29
Thos. Taylor	1	0	2	2	0	1	6

DETAILS OF SINGLE TEST PENS—*continued.*

Competitors.	A.	B.	C.	D.	E.	F.	Total.
HEAVY BREEDS.							
A. E. Walters	21	13	23	17	23	16	113
R. Holmes	11	24	9	19	14	20	97
R. Burns	17	12	5	22	14	16	86
Rev. A. McAllister	15	20	20	9	6	12	82
J. Potter	6	17	16	23	17	1	80
H. M Chaille	18	6	16	20	0	0	60
T. Hindley	0	1	2	20	19	2	44
E. F. Dennis	0	0	18	2	2	12	34
Parisian Poultry Farm	2	11	3	6	1	10	33
C. C. Dennis	0	1	0	0	0	0	1
Miss L. Hart	0	0	1	0	0	0	1
J. E. Smith	0	2	7	0	0	2	11

CUTHBERT POTTS,
Principal.

THE DAIRY HERD, QUEENSLAND AGRICULTURAL COLLEGE, GATTON.

MILKING RECORDS OF COWS FOR APRIL, 1922.

Name of Cow.	Breed.	Date of Calving.	Total Milk.	Test.	Commercial Butter.	Remarks.
			lb.	%	lb.	
Gay Lassie ...	Ayrshire ...	20 Feb., 1922	1,080	4·5	57 00	
Prim	Holstein ...	9 Feb. ,,	1,200	3·5	48·90	
Little Buttercup...	,, ..	12 Dec., 1921	960	4·0	45·00	
Snowflake	Shorthorn...	20 Feb., 1922	840	4·3	42·30	
College Cold Iron	Jersey ...	25 Jan. ,,	660	5·0	39·00	
Magnet's Leda ...	,, ...	8 Feb. ,,	720	4·6	39 00	
Lute	Ayrshire ...	8 Jan. ,,	840	3·8	37·50	
Skylark	,, ...	7 Feb. ,,	870	3·7	37·50	
Auntie's Lass ...	,, ...	31 Oct., 1921	750	3·7	32·40	
Lady Annette ...	,, ...	2 Jan., 1922	660	4·2	32·40	
Hedges Madge ...	Holstein ...	15 Aug., 1921	660	4·2	32·40	
Lilia	Ayrshire ...	3 Mar., 1922	690	3·9	31·20	
Buttercup	Shorthorn...	28 Oct., 1921	720	3·3	30·00	
Thyra of Myrtle-view	Ayrshire ...	31 July, ,,	570	4·2	28·20	
Glow VI.	Guernsey ...	28 Aug. ,,	450	5·2	27·60	
College Ma Petite	Jersey ...	5 Feb., 1922	570	4·1	27·30	
College Bluebell ...	,, ..	22 Oct., 1921	540	4·2	26·70	
College St. Margaret	,, ...	25 Sept. ,,	420	5·2	25 80	
College Evening Glow	,, ...	10 Oct. ,,	450	4·9	25·80	
Lady Meg ...	Ayrshire ...	25 Jan., 1922	570	3·8	25·50	
College Wildflower	Jersey ...	10 Dec., 1921	450	4·8	25·20	
Lady Mitchell ...	Holstein ...	21 Dec. ,,	510	4·2	25·20	
College Prima Donna	,, ...	17 Nov. ,,	630	3·4	24·90	
College Nita ...	,, ...	26 Feb., 1922	570	3·4	22·50	
Miss Security ...	Ayrshire ...	20 Aug., 1921	510	3·7	21·90	
Lady Loch II. ...	,, ...	31 Jan., 1922	450	4·0	21·00	

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF APRIL IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALLS DURING APRIL, 1922 AND 1921, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	April.	No. of Years' Records.	April, 1922.	April, 1921.
North Coast.	In.		In.	In.
Atherton	4·67	21	2·14	11·59
Cairns	12 20	40	11·85	19 72
Cardwell	9 86	50	3·92	3·38
Cooktown	9 24	46	7·68	5·99
Herberton	4·43	35	1 89	7·64
Ingham	9·00	30	4·58	3 07
Innisfail	21·90	41	10 27	19·93
Mossman	12 46	14	6·13	11 86
Townsville	3 90	51	0·27	0 32
Central Coast.				
Ayr	2 94	35	0·02	0·31
Bowen	2 95	51	0·13	0·23
Charters Towers ...	1·80	40	0·05	0 27
Mackay	6·86	51	2 54	3 20
Proserpine	6 92	19	2 51	4 89
St. Lawrence ...	2·84	51	0 61	0·44
South Coast.				
Biggenden	1·78	23	0·09	4·01
Bundaberg	2 94	39	0·50	8 81
Brisbane	3·59	71	0·27	8·06
Childers	2 53	27	0·57	8·47
Crohamhurst ...	5·70	30	1·72	14 66
Esk	2 69	35	0·07	4 85
Gayndah	1 32	51	Nil	1·07
Gympie	3 15	52	0·30	6·76
Glasshouse M'tains	5·18	14	...	9·31
Kilkivan	2 11	43	Nil	3 69
Maryborough ...	3 37	51	0·12	9·76

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	April.	No. of Years' Records.	April, 1922	April, 1921.
South Coast—continued:	In.		In.	In.
Nambour	5·08	26	1·36	11·52
Nanango	1·87	40	0 07	1·94
Rockhampton ...	2·29	35	0 78	1·21
Woodford	4·24	35	0·88	8·94
Darling Downs.				
Dalby	1·26	52	Nil	0·15
Emu Vale	1 20	26	0·05	1·27
Jimbour	1 30	34	Nil	0·19
Miles	1·42	37	Nil	0·13
Stanthorpe ...	1 71	49	0 49	1·48
Toowoomba ...	2·51	50	0·24	3·27
Warwick	1·67	57	0·05	1·17
Maranoa.				
Roma	1·28	48	Nil	Nil
State Farms, &c.				
Bungeworgorai ...	0·86	8	Nil	0 01
Gatton College ...	1·69	23	0·02	1·83
Gindie	1·24	23	Nil	0·08
Hermitage ...	1 32	16	0 03	0 64
Kairi	5·55	8	3·01	14 70
Sugar Experiment Station, Mackay	5·43	25	2·15	2·76
Warren	1·34	8	Nil	0·85

NOTE.—The averages have been compiled from official data during the periods indicated; but the tota for April this year, and for the same period of 1921, having been compiled from telegraphic reports, are subject to revision.

GEORGE E. BOND,
State Meteorologist.

Orchard Notes for July.

THE COAST DISTRICTS.

The marketing of citrus fruits will continue to occupy the attention of growers. The same care in the handling, grading, and packing of the fruit that has been so strongly insisted upon in these monthly notes must be continued if satisfactory returns are to be expected. Despite the advice that has been given over and over again, some growers still fail to grasp the importance of placing their fruit on the market in the best possible condition, and persist in marketing it ungraded, good, blemished, and inferior fruit being met with in the same case. This, to say the least, is very bad business, and as some growers will not take the necessary trouble to grade and pack properly, there is only one thing to do, and that is to fix standards of quality and see that the fruit offered for sale complies with the standards prescribed and that the cases are marked accordingly.

Where the crop has been gathered, the trees can be given such winter pruning as may be necessary, such as the removal of broken or diseased limbs or branches, and the pruning out of any superfluous wood from the centre of the tree. Where gumming of any kind is seen it should be at once attended to. If at the collar of the tree and attacking the main roots, the earth should be removed from around the trunk and main roots—all diseased wood, bark, and roots should be cut away, and the whole of the exposed parts painted with Bordeaux paste.

When treated, do not fill in the soil around the main roots, but allow them to be exposed to the air for some time, as this tends to check any further gumming. When the gum is on the trunk or main limbs of the tree, cut away all diseased bark and wood till a healthy growth is met with, and cover the wounds with Bordeaux paste.

If the main limbs are infested with scale insects or attacked by any kind of moss, lichen, or fungus growth, they should be sprayed with lime sulphur.

Towards the end of the month all young trees should be carefully examined for the presence of elephant beetles, which, in addition to eating the leaves and young bark, lay their eggs in the fork of the tree, and when the young hatch out they eat their way through to the wood and then work between the wood and the bark, eventually ringbarking one or more of the main limbs, or even the trunk. A dressing of strong lime sulphur to the trunk and fork of the tree, if applied before the beetles lay their eggs, will act as a preventive. In the warmer parts a careful watch should also be kept for the first appearance of any sucking bugs, and to destroy any that can be found. If this is done systematically by all growers the damage done by this pest will be very much reduced.

Citrus trees can be planted throughout the month. Take care to see that the work is done in accordance with the instructions given in the June notes. All worn-out trees should be taken out, provided the root system is too far gone to be renovated, but when the root system is still good the top of the tree should be removed till sound, healthy wood is met with, and the portion left should be painted with a strong solution of lime sulphur. If this is done the tree will make a clean, healthy growth in spring.

Land intended for bananas and pineapples can be got ready, and the existing plantations should be kept in a well-cultivated condition so as to retain moisture in the soil.

Bananas intended for sending South can be allowed to become fully developed, but not coloured, as they carry well during the colder months of the year, unless they meet with a very cold spell when passing through the New England district of New South Wales, when they may be injured by the cold.

The winter crop of smoothleaf pines will commence to ripen towards the end of the month, and when free from black heart (the result of a cold winter) or from fruitlet core rot, they can well, as they are of firm texture and stand handling. Where there is any danger of frost or even of cold winds, it pays to cover pines and also the bunches of bananas. Bush hay is used for the former, and sacking for the latter.

Strawberries should be plentiful during the month, provided the weather is suitable to their development, but if there is an insufficient rainfall, then irrigation is required to produce a crop. Strawberries, like all other fruits, pay well for careful handling, grading, and packing, well-packed boxes always realising a much higher price than indifferently packed ones on the local market. Where strawberries show signs of leaf blight or mildew, spray with Bordeaux mixture for the former and with sulphide of soda for the latter.

When custard apples fail to ripen when gathered, try the effect of placing them in the banana-ripening rooms, and they will soon soften instead of turning black.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

July is a busy month for the growers of deciduous fruits, as the important work of winter pruning should, if possible, be completed before the end of the month, so as to give plenty of time for spraying and getting the orchard into proper trim before spring growth starts.

With regard to pruning, follow the advice given in the June number; and if you are not thoroughly conversant with the work, get the advice of one or other of the Departmental officers stationed in the district.

Pruning is one of the most important orchard operations, as the following and succeeding seasons' crops depend very largely on the manner in which it is carried out. It regulates the growth as well as the number and size of the fruit, as if too much bearing wood is left, there is a chance of the tree setting many more fruits than it can properly mature, with a result that unless it is rigorously thinned out, it is undersized and unsaleable. On the other hand, it is not advisable to unduly reduce the quantity of bearing wood, or a small crop of overgrown fruit may be the result.

Apples, pears, and European varieties of plums produce their fruit on spurs that are formed on wood of two-years' growth or more; apricots and Japanese plums on new growth, and on spurs; but peaches and nectarines always on wood of the previous season's growth, as once peachwood has fruited it will not produce any more from the same season's wood, though it may develop spurs having a new growth or new laterals which will produce fruit.

The pruning of the peaches and nectarines, therefore, necessitates the leaving of sufficient new wood on the tree each season to carry a full crop, as well as the leaving of buds from which to grow new wood for the succeeding year's crop. In other words, one not only prunes for the immediately succeeding crop, but also for that of the following season.

All prunings should be gathered and burnt, as any disease that may be on the wood is thoroughly destroyed. When pruned, the trees are ready for their winter spraying with lime-sulphur.

All kinds of deciduous trees can be planted during the month provided the ground is in a proper state to plant them. If not, it is better to delay planting until August, and carry out the necessary work in the interval. The preparation of new land for planting can be continued, although it is somewhat late in the season, as new land is always the better for being given a chance to mellow and sweeten before being planted. Do not prune vines yet on the Granite Belt; they can, however, be pruned on the Downs and in the western districts.

Trees of all kinds, including citrus, can also be planted in suitable situations on the Downs and western districts, and the pruning of deciduous trees should be concluded there. If the winter has been very dry, and the soil is badly in need of moisture, all orchards in the western districts, after being pruned and ploughed, should receive a thorough irrigation (where water is available) about the end of the month, so as to provide moisture for the use of the trees when they start growth. Irrigation should be followed by a thorough cultivation of the land to conserve the water so applied. As frequently mentioned in these notes, irrigation and cultivation must go hand in hand if the best results are to be obtained, especially in our hot and dry districts.

Farm and Garden Notes for July.

FIELD.—Practically the whole of the work on the land for this month will be confined to the cultivation of winter crops, which should be now making good growth, and to the preparation of land for the large variety of crops which can be sown next month. Early-maturing varieties of wheat may be sown this month. The harvesting of late-sown maize will be nearing completion, and all old stalks should be ploughed in and allowed to rot. Mangels, swedes, and other root crops should be now well away, and should be ready for thinning out. Frosts, which can be expected almost for a certainty this month, will do much towards ridding the land of insect pests and checking weed growth. Cotton-picking should be now practically finished and the land under preparation for the next crop. The young lucerne should be becoming well established; the first cutting should be made before the plants flower—in fact, as soon as they are strong enough to stand the mowing machine, and the cutting of subsequent crops should be as frequent as the growth and development of the lucerne plants permit. Ordinarily cutting should be regulated to fit in with the early flowering period—*i.e.*, when about one-third of the plants in the crop are in flower.

KITCHEN GARDEN.—Should showery weather be frequent during July, do not attempt to sow seeds on heavy land, as the latter will be liable to clog, and hence be injurious to the young plants as they come up. The soil should not be reworked until fine weather has lasted sufficiently long to make it friable. In fine weather, get the ground ploughed or dug, and let it lie in the rough till required. If harrowed and pulverised before that time, the soil is deprived of the sweetening influences of the sun, rain, air, and frost. Where the ground has been properly prepared, make full sowings of cabbage, carrot, broad beans, lettuce, parsnips, beans, radishes, leeks, spring onions, beetroot, eschalots, salsify, &c. As westerly winds may be expected, plenty of hoeing and watering will be required to ensure good crops. Pinch the tops of broad beans which are in flower, and stake up peas which require support. Plant out rhubarb, asparagus, and artichokes. In warm districts, it will be quite safe to sow cucumbers, marrows, squashes, and melons during the last week of the month. In colder localities, it is better to wait till the middle or end of August. Get the ground ready for sowing French beans and other spring crops.

FLOWER GARDEN.—Winter work ought to be in an advanced state. The roses will not want looking after. They should already have been pruned, and now any shoots which have a tendency to grow in wrong directions should be rubbed off. Overhaul the ferneries, and top-dress with a mixture of sandy loam and leaf mould, staking up some plants and thinning out others. Treat all classes of plants in the same manner as the roses where undesirable shoots appear. All such work as trimming lawns, digging beds, pruning, and planting should now be got well in hand. Plant out antirrhinums, pansies, holly-hocks, verbenas, petunias, &c., which were lately sown. Sow zinnias, amaranthus, balsam, chrysanthemum tricolour, marigold, cosmos, coxcombs, phoixes, sweet peas, lupins, &c. Plant gladiolus, tuberoses, amaryllis, pancratium, ismene, crinums, belladonna, lily, and other bulbs. Put away dahlia roots in some warm, moist spot, where they will start gently and be ready for planting out in August and September.

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON, F.R.A.S.

TIMES OF SUNRISE AND SUNSET.

AT WARWICK.

1922.	APRIL.		MAY.		JUNE.	
Date.	Rises.	Sets.	Rises.	Sets.	Rises.	Sets.
1	6·2	5·50	6·18	5·20	6·36	5·3
2	6·3	5·49	6·18	5·19	6·36	5·3
3	6·3	5·48	6·19	5·18	6·37	5·3
4	6·4	5·47	6·20	5·17	6 37	5·3
5	6·5	5·45	6·21	5·17	6·38	5·2
6	6·5	5·44	6·22	5·16	6·38	5·2
7	6·6	5·43	6·22	5·16	6·39	5·2
8	6·6	5·42	6 23	5·15	6·39	5·2
9	6·7	5·41	6·23	5·14	6·40	5·2
10	6 7	5·40	6 24	5·14	6·40	5·2
11	6·8	5·39	6 25	5·13	6·41	5·2
12	6 8	5·38	6·25	5·13	3·41	5·2
13	6·9	5 37	6·26	5·12	6·42	5·2
14	6·9	5·36	6·26	5·12	6·42	5·2
15	6·10	5·35	6 27	5·11	6·42	5·3
16	6·10	5·34	6·27	5·10	6·42	5·3
17	6·11	5·33	6·28	5·10	6·42	5·3
18	6·11	5·32	6 28	5·9	6·43	5·3
19	6·12	5·31	6·29	5·9	6·43	5·4
20	6·12	5·30	6·29	5·8	6·43	5·4
21	6·13	5·29	6 30	5·8	6·43	5·4
22	6·13	5·28	6·31	5·7	6·43	5 4
23	6·14	5·27	6·31	5·7	6·43	5·4
24	6·14	5·26	6·32	5·6	6·44	5·4
25	6·15	5 25	6·32	5·6	6·44	5·4
26	6·15	5 24	6·33	5·5	6 44	5·5
27	6·16	5·23	6 33	5·5	6 44	5·5
28	6·16	5·22	6·34	5·4	6·44	5·5
29	6 17	5·22	6·34	5·4	6·44	5·5
30	6·17	5·21	6·35	5·3	6·44	5·6
31	...	...	6.35	...	...	...

PHASES OF THE MOON, OCCULTATIONS, &c.

The times stated are for Queensland, New South Wales, Victoria, and Tasmania when "Summer Time" is not used.

			H. M.
5 April	☾	First Quarter	3 46 p.m.
12 „	○	Full Moon	6 44 a.m.
19 „	☽	Last Quarter	10 54 a.m.
27 „	●	New Moon	3 4 p.m.

Perigee on 10th at 6·36 p.m.
Apogee on 22nd at 8·12 p.m.

The moon will pass, apparently, close to Jupiter on the 11th soon after sunset. If viewed from a higher southern latitude the moon will be seen to occult the planet.

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4 May	☾	First Quarter	10 56 p.m.
11 „	○	Full Moon	4 6 p.m.
19 „	☽	Last Quarter	4 17 a.m.
27 „	●	New Moon	4 4 a.m.

Perigee on 8th at 5·12 p.m.
Apogee on 20th at 2 30 p.m.

On the 8th, between 11 and 12 p.m., the moon will be again very near, apparently, to Jupiter in the constellation Virgo, with the very interesting binary star—Gamma Virginis—slightly below them.

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3 June	☾	First Quarter	4 10 a.m.
10 „	○	Full Moon	1 38 a.m.
17 „	☽	Last Quarter	10 3 p.m.
25 „	●	New Moon	2 20 p.m

Perigee on 4th at 5·12 a.m. and on 29th at 1·24 p.m.
Apogee on 17th at 9·18 a.m.

The moon will pass Saturn on the 4th at a quarter past three in the afternoon, and will enable this planet to be seen in the daytime if a small telescope or binoculars are directed about six times the moon's diameter northward. It will also pass Jupiter on the 5th a little before four o'clock in the morning, again in apparent proximity to Gamma Virginis. Jupiter will again be occulted in high southern latitudes.

Venus, Jupiter, and Saturn will be evening stars during these three months. Mars will be somewhat later in rising, but will be visible early in the evening during the latter part of the period.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S., add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter, and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhere about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

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